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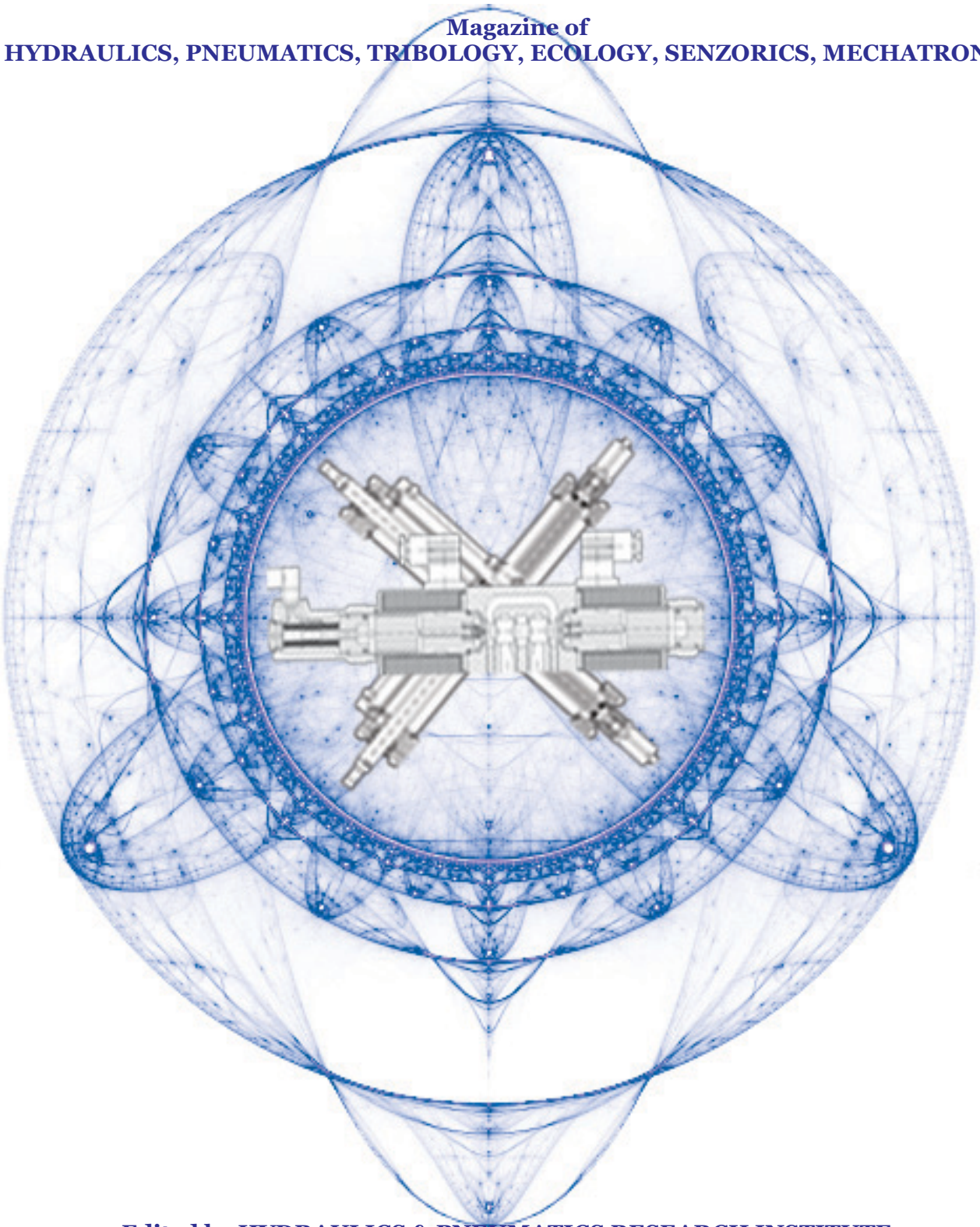
Hidraulica

Magazine of
HYDRAULICS, PNEUMATICS, TRIBOLOGY, ECOLOGY, SENZORICS, MECHATRONICS



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CONTENTS

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EDITORIAL

ABOUT TARGETINGS

Ph.D.eng. Petrin DRUMEA
MANAGER INOE 2000 - IHP

In the last years the professional meetings with the specialized Romanian manufacturing companies from the field have been dominated by questions like: "What would be better to set into production?" "Which are the European trends in the field of hydro pneumatics?" "How can I diversify production for being competitive on the market?" "How could we obtain some credits or less expensive facilities?" At first sight all these questions and many others seem to have their answers in other fields, probably in politics where it seems that are so much found incompetence and inactivity. Could this be the truth? Analyzing the matters closely and gradually we find that there are a series of elements which prove the incapability of the specialized manufacturing companies in understanding the economic evolution and particularly the evolution of the fluid power field. These companies are the one which do not participate at national and international fairs even when the costs are not due to them.Who stops these companies to get in touch with marketing or research specialists who know the actual European and global trends and have direct access to the information required for developing a profitable industrial activity in Romania. It is not normal to see that the small manufacturers do not try to get any advantage from accessing these information found in the databases of the professional association and ask for support in establishing contacts, not taking into account its relationship system or its regular meetings with specialists from home and abroad. Each year at HERVEX are presented informational reports about the European and international markets, the existent trends and tendencies. The small manufacturers have the chance to participate at the FLUIDAS meetings or at the workshops organized at HERVEX, at the presentation of some programs of development supported by the EU or the Romanian government for which the research institutions or non governmental organizations have the expertise and willingness to submit joint project proposals. The credits are cheap and the facilities are significant for a manufacturer only if are used for well structured, realistic projects which take into account the economic situation from Romania and Europe. The development of products without any future on the market and without any market to sell them will generate problems to the companies which access the funds only for the sake of making simple act of their presence. I still believe that our companies cannot be accepted on the specialized national and international markets in any field, knowing the tough competition existent in the field. I believe that the Romanian manufacturing companies must concern about setting into production unique products or of small series, of hydraulic systems specific for complex installations, of niche equipment or of equipment which represent patents of the Romanian specialists. It may be possible that the foreign manufacturer would ask from Romanian producers for executing some subassemblies or components and in special situations for manufacturing equipment for which we have the required competency in order to be accepted on the international markets. The small companies should also concern about the activities of maintenance and repairing because these may represent good directions of development for our industry and may also be the first step in a potential international cooperation without which the field cannot develop satisfactorily in our country. In order to reach these goals it is necessary from time to time for the companies to provide the professional training for the technical staff they have. All these thoughts expressed in the present editorial cover just a small part of the entire matter referring at the directions to be followed by the Romanian companies and represent just a personal view. I wish you success and prosperity.

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EDITORIAL

DESPRE DIRECTIONARI

Dr.Ing. Petrin DRUMEA
DIRECTOR INOE 2000 - IHP

In ultimii ani intalnirile profesionale cu firmele de profil din Romania sunt dominate de intrebari de tipul "Ce ar fi bine sa mai introduc in fabricatie? ; Care sunt tendintele europene in domeniul hidro-pneumaticii? ; Cum pot diversifica piata pentru firma mea? ; Cum pot obtine niste credite sau niste facilitati mai ieftine? " La prima impresie toate aceste intrebari si multe altele par a avea raspunsurile in afara domeniului, probabil in zona politicului, acolo unde se pare ca s-ar grupa incompetenta si inactivitatea. Oare asa o fi? Analizand lucrurile pas cu pas, apar surprinzator o serie de elemente care ne trimit la incapacitatea reprezentantilor firmelor de intelege mersul economiei si mai ales al domeniului. Aceste firme sunt cele care nu participa la targurile nationale si internationale chiar si atunci cand o buna parte a costurilor sunt suportate de altii. Cine opreste aceste firme sa ia contact cu cei specializati in marketing sau in cercetare si care cunosc tendintele europene si mondiale si care au acces la informatiile necesare unei desfasurari industriale a activitatii producatorilor din tara. Este anormal ca micii producatori sa nu profite din plin de bazele de date ale asociatiei profesionale, de sistemul relational al acesteia si de intalnirile periodice ale specialistilor organizate la nivel national si international. In fiecare an in cadrul HERVEX sunt prezentate materiale despre pietele europene si mondiale atat ca realizari cat si ca tendinte. Micii producatori au sansa de a participa in cadrul sedintelor FLUIDAS cat si in cadrul unor workshop-uri la HERVEX la prezentarea unor programe de dezvoltare sustinute de UE sau de guvernul Romaniei pentru care unitatile de cercetare sau unele ONG-uri au experienta si dorinta de a depune proiecte comune. Creditele sunt ieftine iar facilitatile sunt importante pentru un producator numai daca se utilizeaza pentru proiecte bine structurate, bine gandite si bine ancorate in realitatea economica din Romania si din Europa. Dezvoltarea unor produse fara viitor si fara piata vor crea mari neplaceri firmelor care acceseaza fondurile doar de dragul participarii si cu speranta unor intamplari norocoase. In continuare eu cred ca firmele noastre nu se pot impune la nivel national sau european pe orice domeniu stiind concurenta acerba existenta pe plan mondial pe produsele de serie mare. De aceea eu cred cu consecventa ca firmele din tara trebuie sa fie preocupate de introducerea in fabricatie a echipamentelor unicat sau de serie mica, a sistemelor hidraulice specifice unor utilaje complexe, a unor echipamente de nisa sau a unor echipamente care rezulta din brevete ale specialistilor din tara. Este posibil ca unii producatori straini sa apeleze la micii producatori romani pentru executia unor repere sau/si subansamble iar in situatii speciale la fabricarea unor echipamente pentru care noi sa dispunem de competentele necesare incadrarii in competitia internationala. Firmele mici ar trebui sa se preocupe si de activitatile de mentenanta si reparatii, pentru ca pot reprezenta directii de mare interes national si de asemenea pot constitui un prim pas in cooperarea internationala fara de care sigur nu se poate dezvolta domeniul in tara noastra. Pentru toate acestea este necesar ca din timp in timp firmele sa asigure perfectionarea pregatirii profesionale pentru toate cadrela tehnice de care dispun. Toate aceste ganduri exprimate in prezentul editorial acopera doar o mica parte a directiilor pe care trebuie sa mearga firmele romanesti si sigur sunt doar o parere personala.
Va urez succes si multa sanatate.

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PRESENTING THE UNITS FROM FLUIDAS

HYDRAULICS AND PNEUMATICS RESEARCH INSTITUTE

HYDRAULICS & PNEUMATICS RESEARCH INSTITUTE (IHP) in Bucharest - ROMANIA is a research, design and production unit in the field of hydraulics and pneumatics, is a subsidiary of the National Institute of Research & Development for Optoelectronics - INOE 2000, concerned with the hydraulics and pneumatics fields, which has integrated current trends of applied research such as: environmental protection, ecological agriculture and water reserves, industrial mechatronics and health.

The institute, holding over 55 years of experience in its activity field, is structured on 3 research and development divisions : Division of basic hydraulics**,** Division of servo techniques, electronics and mechatronics, Division of special equipment. IHP personnel are highly qualified manpower, while its divisions hold an adequate endowment consisting of cutting-edge devices, electronic equipment and automatic adjustment and control systems and 10 laboratories of experimental research.

Team of researchers is composed of 2 SR I, , 2SR II, 14SR III, 5SR, 2 TDE II, 4 TDE III , 9 ASR si 2 TDE, of which a total of 14 specialists are doctors engineers.

Basic research directions are:

1. HYDROTRONICS, MECHATRONICS AND TRIBOLOGY

The activities developed in this direction aim to improve performances and lifetime of complex automation systems based on hydraulic, mechanical and pneumatic equipment, combined with electronic and informatic central or local systems, including the development of components and systems with local intelligence.

Activities in this direction regard:

- Optimization of energy consumption by using digital hydraulics, which reduces energy consumption by superior adapting to the immediate requirements of hydraulic systems, even without circuits for recovery, conversion and energy storage
- Tribology of mobile seals in the mechanical systems, in order to reduce energy consumption and component wear
- Tribology of mechanical couplings in hydrostatic equipment
- Improved dynamic and tribological performances of hidraulic-mechanical systems using servo equipment
- The introduction, implementation and development of modern concepts of hydrotronics, mecatronics and pneutronics as a base for the modernization of hydraulic and pneumatic drive systems
- Research on optimizing mobile equipment operation using mechatronics based on informatics, sensor science and electronics specific for hydraulic drives
- Increased working pressure in hydraulic systems by using new materials in the construction of hydraulic and pneumatic equipment
- Development of equipment and systems equipped with electrohydraulic central and local intelligence for learning repetitive movements or performed in some default parameters.

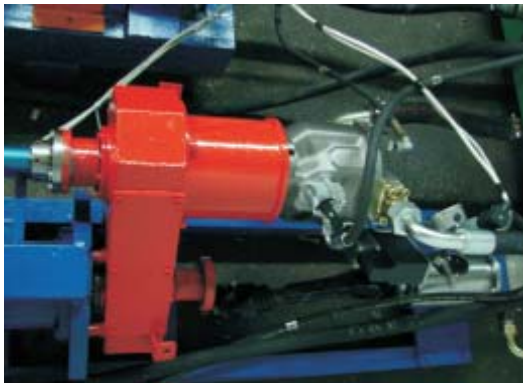




2. GREEN ENERGIES

Green energy is a priority research area and an opportunity to work for our institute, aimed at developing technologies and equipment with mechanical, hydraulic, pneumatic or electric drive to capture, produce and use of renewable energy.


Increasing importance of this area in general activity of the institute was made possible taking into account the possibilities of reducing energetic costs from various branches of activity, where the hydraulic or pneumatic drives are present.

The activities of perspective appertaining to this trend, for the following years, are focused to achieve the following:

- Studies and research for producing biogas from sediments obtained as a result of treating wastewaters in specialized plants
- Studies for reducing volume and weight of wastes using solar energy and other kinds of green energies
- Studies regarding the use of the wave energy in static applications (installations of conversion into mechanical, hydraulic or electric energy) or in mobile applications (for propulsion or other secondary functions of the naval ships)
- Studies for optimizing kinematic networks from the structure of the eolian turbines by using hydraulic drives
- New methods for the conversion and use of the vegetal waste (from forestry, agriculture), as a raw material for obtaining thermal energy
- Studies regarding the possibilities of using combined two or more renewable energy sources for reducing the energetic consumption from classic sources
- Studies regarding the improvement of the performances of the installations for producing electric energy using hydro resources (small hydropower plants)
- Studies regarding the use of various vegetal waste in installations for producing thermal energy using the intermediary conversion into gasogen

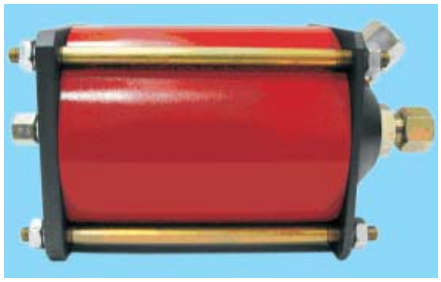
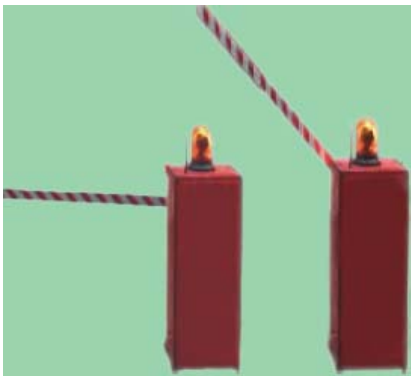
3. TECHNOLOGICAL TRANSFER

The technological transfer has as strategically objective the exploitation of the potential represented by research and development activities results by implementing it in production at industrial units.





Technology transfer is seen as the main way of raising the industrial activity, both considering the existence of many high-level scientific results which are not used, as well as low level of activity based on results of scientific research, in general.

The research and development results which can be transferred are both products and technologies obtained in R&D activities.

The activities envisaged in this direction for the next years aim to realize:

- Remote control for operation of hydraulic systems which were transferred in industry
- Management systems of maintenance for extending operation time, which reduces operation costs
- Methodologies for rapid technological transfer from research units to industrial units
- Education of research workers and producers for reducing the time spend in technological transfer
- Promotion in manufacturing of products with higher efficiency, resulting from R&D on national programs and projects
- Development of mixed research partnerships between the institute and enterprises, as the basis of an effective and appropriate technological transfer
- Development of partnerships with institutions of research units and divers organizations in order to advance and support technological transfer possibilities.
- Developing of projects (in national and international programs) which have the objective to accelerate the introduction into production of research results, in hydraulic and pneumatic field
- Large scale dissemination of results of research and development from specialized units which can be introduced in production

As you can see the institute has a wide range of areas in which can enter with original and innovative ideas, which are supported by the patents obtained and applications submitted to the accredited body.

As a interest field of national and international is desired:

- Increased visibility
- Stabilization within the institute personnel and attracting young students in research activities the approach of researches with ending in the technology transfer

GUIDING PRINCIPLES:

- Scientific performance
- Providing knowledge and results to beneficiaries
- Compatibility of the own infrastructure with those of high technical and technological level existent at European level
- Adaptability and flexibility
- Global and unitary vision
- Non discrimination

PRIORITIES:

- The expanding of the capacity of approachment of the complex multidisciplinary research
- The increased acknowledgement of the institute at national and international level by its technical and scientific results and the participation at international projects which to make possible its integration in the European research networks
- The stabilization of its staff and the employment of young researchers
- The development of the research and innovation activities in the regional area
- The creation of an efficient system of evaluation at the level of a coherent unity in the field of the research programmes
- The development of the infrastructure and the connecting to European centers of excellence
- The integration in the European research environment taking into account the thematics of the technological platforms
- The approach of research with finality in the field of technological transfer

Also, the institute hold a micro manufacturing base gathers a team of mechanical workers and one of locksmith and repairing workers. The mechanical workers' group have a large range of equipments (lathes, drills, grinding machines and so on) with which can be worked out and fixed various hydraulic systems such as hydraulic cylinders, pumps, rotary engines, battery directional control valves.


All these are tried and tested in the three accredited laboratories:

- Testing laboratory for high pressure equipment;

-Testing laboratory for hydraulic equipment of medium and high pressure


- Testing laboratory for lubrication equipment and systems

HYDRAULICS & PNEUMATICS RESEARCH INSTITUTE also holds a library comprising over 1000 technical books, collections of journals from the field of hydraulics and pneumatics, electronics and mechatronics, as well as a large number of company catalogues and leaflets.

The results of the research developed within the institute were concretized in a number of 44 patents of invention and 20 applications submitted to OSIM, over 650 technical and scientific articles published in specialized national and international magazines and proceedings

HYDRAULICS & PNEUMATICS RESEARCH INSTITUTE is able to offer a wide range of services:

• Modernization of hydraulically/pneumatically actuated complex devices
• Reconditioning of hydraulic components (pumps, directional control valves, valves, et cetera) as well as complete hydraulic/pneumatic/oil lubrication installations
• Reconditioning of hydraulic/pneumatic installations by replacing the original worn out devices with the equivalent ones
• Reconditioning and adjustment of hydraulic/pneumatic equipment for automation such as servo valves and proportional devices
• Elaboration of technical, technical-economical, marketing studies or marketing research and feasibility studies in the field of fluid and pneumatic power systems

• Technical consulting services in the field of hydraulic and pneumatic drives, centralized oil lubrication, sealing, gauging the water or heat consumption
• Technical survey in the same fields
• Elaboration of operation and maintenance tutorials for driving and automating complex hydro and pneumatic machineries
• Implementing the Quality Management System specific to hydraulic and pneumatic equipment manufacture
• Elaboration and implementation of special computer programs for various activities in the field of hydraulics and pneumatics
• Tutoring rules and schooling on operation and maintenance works in the same field.

You will find usefull information at: **www.ihp.ro**

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THE INTERNATIONAL SCIENTIFIC SYMPOSIUM HERVEX 2011

Between 9th -11th November 2011, at Calimanesti Caciulata took place the 19th edition of the International Symposium of hydraulics, pneumatics, fine mechanics and mechatronics- HERVEX 2011.

This represents a major event in the field, promoting an important domain, which could contribute decisively at the revival of the national economy.

The organizers of the symposium were:

- Hydraulics and Pneumatics Research Institute, Bucharest, Romania – INOE 2000-IHP

- Chamber of Commerce and Industry Valcea, Romania

in partnership with:

- **POLITEHNICA University of Bucharest, Romania**
- **"Gheorghe Asachi" Technical University of Iasi, Romania**
- **Development and Assessment Institute in Waste Water Technology – PIA, Aachen, Germany**
- **Wroclaw University of Technology, Poland**

This scientific reunion held under the patronage of European Fluid Power Committee - **CETOP** and with support of National Authority for Scientific Research from Romania - **ANCS** and National Professional Association of Hydraulics and Pneumatics – **FLUIDAS** provide the most propitious framework for promoting the new achievements from the fields of hydraulics, pneumatics, fine mechanics and mechatronics, the most sucessful results of the research activities and show them in an exhibition.

The theme of the 19th Edition of the International Salon is:

"ENERGY EFFICIENCY IN FLUID POWER"

At the official opening were present representatives of some institutions in Valcea, Valcea Chamber of Commerce and Industry, representatives of companies interested in research field.
Have spoken:
- Prof. PhD.Eng. Constantin RANEA - National Authority for Scientific Research
- Valentin Cismaru – President of Chamber of Commerce and Industry Valcea, Romania
- PhD. Eng. Petrin DRUMEA – Manager of Hydraulics and Pneumatics Research Institute in Bucharest, Romania / President of FLUIDAS Association, Romania



PRESENTATION OF THE MAIN ACTIVITIES

The main activities carryed out throughout the symposium were the following:
- Sessions for presenting technical scientific reports
- Workshops on update issues from the field
- Exhibition of products
- Brokerage
- Presentation of firms

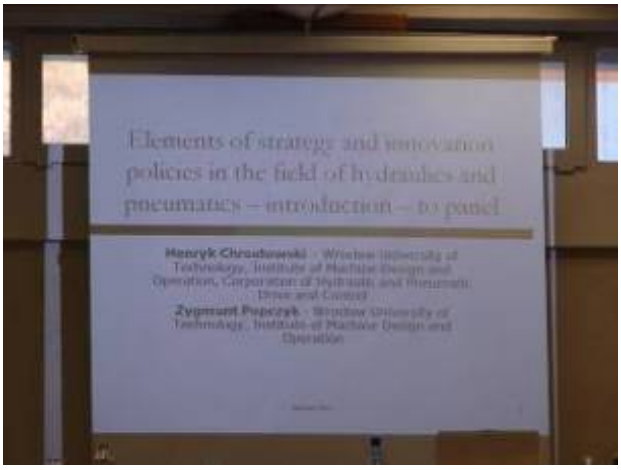
THE SCIENTIFIC SESSIONS

These took place on November 9th and 11th focusing on the following domains:
- MOBILE and INDUSTRIAL HYDRAULICS
- ENVIRONMENT, ECOLOGY AND RENEWABLE ENERGY
- INNOVATION AND TECHNOLOGICAL TRANSFER
- ELEMENTS OF STRATEGY AND INNOVATIVE POLICIES IN THE FIELD OF HYDRAULICS AND PNEUMATICS
- MODERN TRENDS IN SPECIALIZED RESEARCH RESULTED FROM INTERNATIONAL CONFERENCES
- HUMAN RESOURCES DEVELOPMENT IN FLUID POWER

PRESENTATION OF THE SESSIONS

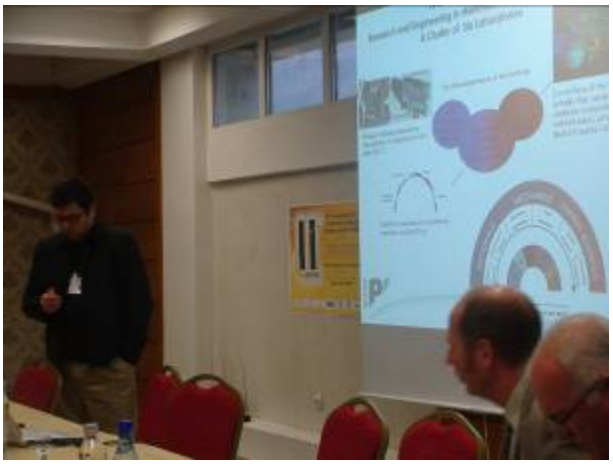
***The first scientific sessions* "ELEMENTS OF STRATEGY AND INNOVATIVE POLICIES IN THE FIELD OF HYDRAULICS AND PNEUMATICS"** was led by:
PhD. Eng. Henryk CHROSTOWSKI – Head of Hydraulic Machines and Systems Division -Institute of Machine Design and Operation -Wroclaw University of Technology, Poland / President of Corporation of Hydraulic and Pneumatic Drives and Controls -Poland
PhD. Eng. Petrin DRUMEA – Manager of Hydraulics and Pneumatics Research Institute in Bucharest, Romania / President of FLUIDAS Association, Romania
Prof. PhD.Eng. Constantin RANEA - National Authority for Scientific Research
Prof. PhD. Eng. Nicolae ALEXANDRESCU - Politehnica University of Bucharest, Romania

In this session Mr. PhD.Eng. Krzysztof KEDZIA from Institute of Machine Design and Operation - Wroclaw University of Technology, Poland, sustained an paper with title *"Elements of Strategy and Innovative Policies in The Field of Hydraulics and Pneumatics",* elaborated by PhD. Eng. Henryk CHROSTOWSKI and PhD. Eng. Zygmunt Popczyk.



***The second session* "MOBILE HYDRAULICS"** was led by:
PhD. Eng. Krzysztof KEDZIA – Institute of Machine Design and Operation -Wroclaw University of Technology, Poland
Prof. PhD.Eng. Pavel MACH – Technical University of Praga, Cehia
Prof. PhD. Eng. David ION – Dean of Faculty of Technological Machines -Technical University of Civil Engineering Bucharest, Romania
PhD. Eng. Corneliu CRISTESCU –Hydraulics and Pneumatics Research Institute in Bucharest, Romania
Mr. PhD. Eng. Krzysztof KEDZIA sustained the invited paper called: „Work Analysis of the Hydrostatic Drive System of a Crawler Transporter -Tur 600"

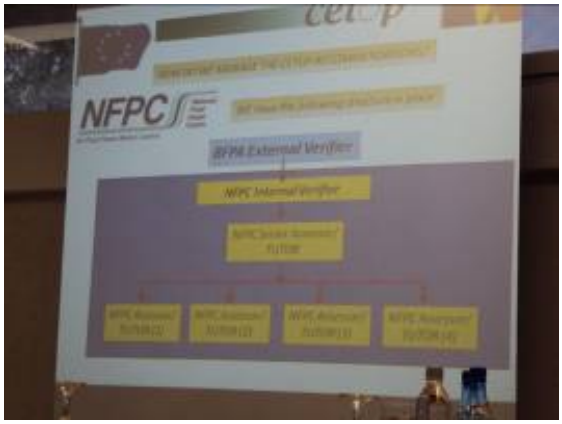
The second invited paper was sustained by Assoc. PhD.eng. Aurelian Fatu from PPRIME Institute at the University of Poitiers from France, called: " Research Directions of the University of Poitiers"



The third session "**MODERN TRENDS IN SPECIALIZED RESEARCH RESULTED FROM INTERNATIONAL CONFERENCES"** was led by:
PhD. Eng. Heinrich THEISSEN – Scientific Director of Institute for Fluid Power Drives and Controls – IFAS, Aachen, Germany
PhD. Eng. Catalin DUMITRESCU - Hydraulics and Pneumatics Research Institute in Bucharest, Romania
In this session Mr. PhD. Eng. Heinrich THEISSEN sustained the invited paper called: „Fluid Power for Sustainability", which has enjoyed a great interest from the auditorium.

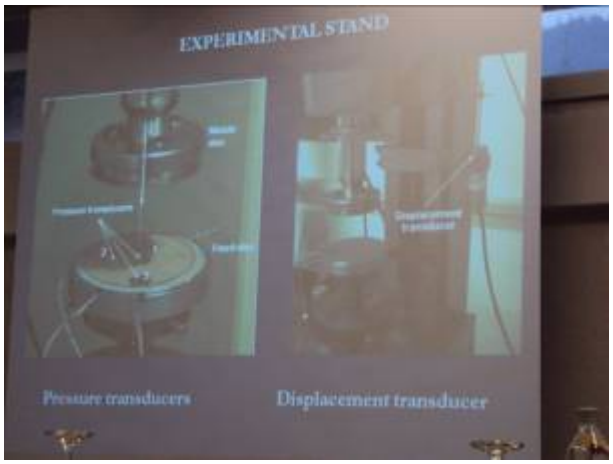
The four sesions "**INDUSTRIAL HYDRAULICS"** was led by:
PhD. Eng. Ioan LEPADATU– Hydraulics and Pneumatics Research Institute in Bucharest, Romania
Prof. PhD. Eng. Ilare BORDEASU– Politehnica University from Timisoara, Romania
Prof. PhD. Eng. Alexandru MARIN– Politehnica University of Bucharest, Romania

The fifth sesion "**HUMAN RESOURCES DEVELOPMENT IN FLUID POWER"** was led by:
John SAVAGE – Vice President CETOP – Education / BFPA Chairman Education and Training, England
Prof. PhD. Eng. Valeriu BANU – "POLITEHNICA" University of Bucharest / Technical Manager - SMC Romania
PhD. Eng. Iulian DUTU – Hydraulics and Pneumatics Research Institute in Bucharest, Romania
Prof. PhD. Eng. Dan OPRUTA - Technical University of Cluj Napoca, Romania
In this session Mr. John SAVAGE sustained a wide interest paper that has polarized the auditorium and was appreciated by both the representatives of companies in the Fluid Power, as well as by those from academia, which they found a relevant work in the field of education and training in FLUID POWER.
The presentation was focused on the following directions:
- Recommendations CETOP for Education and Training in FLUID POWER
- Presentation of the National Center for FLUID POWER - Center for Professional Excellence in England.
- Presentation of the Education Commission of the CETOP



Also, Mr. Assoc. PhD. Eng Alexandru Valentin Radulescu from the POLITEHNICA University of Bucharest sustained the paper called: "Advanced Technologies used in Education and Training for Lubrication Processes"**.**

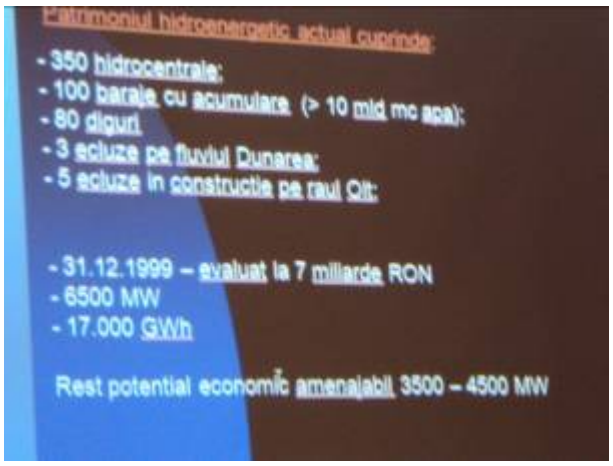
Paper that attracted interest of the audience has presenting the significant issues for education and training in FLUID POWER



PRESENTATION OF THE WORKSHOPS

Firs workshop "**ENVIRONMENT, ECOLOGY AND RENEWABLE ENERGY"** was led by:
PhD. Eng. Elmar DORGELOH – Manager of Development and Assessment Institute in Waste Water Technology at RWTH Aachen University, Germany
PhD. Eng. Ion PIRNA – General Manager - National Institute Of Research - Development for Machines and Installations Designed to Agriculture and Food Industry – INMA, Bucharest- Romania
Associate Professor PhD. Eng. Erol MURAD - Politehnica University of Bucharest, Romania
PhD. Eng. Catalin DUMITRESCU - Hydraulics and Pneumatics Research Institute in Bucharest, Romania
In this workshop Mr. PhD. Eng. Elmar DORGELOH sustained the paper : „ Environment and Ecology", which had a great impact among those present in the room, and generating the questions from auditorium, which resulting a interesting scientific discussion with a guest from Germany.

Also, the paper presented by PhD.eng.Paraianu Constantin, the representative of the AGIR - Branch Ramnicu Valcea, has generated a real interest from the auditorium.



The second workshop "**INVENTORS CLUB"** was led by:
Prof. PhD. Eng. Dan OPRUTA – Technical University of Cluj, Romania
Dipl.Eng. Gheorghe RIZOIU – General Manager of Chamber of Commerce and Industry Valcea, Romania
PhD.Eng. Adrian MIREA – General Manager - SC. GENERAL FLUID SA Bucuresti, Romania

In this workshop Mr. PhD.Eng. Ioan Pop from Technical University of Cluj Napoca, presented the possibilities of sonics transmission for flexible industrial applications.


The inventor Cornelius Marin who has made an interesting invention, OSIM already deposited for patent, which refers to a heat engine with an spherical piston that makes four-stroke develop a single rotation.
This presentation attracted the interest of the audience who asked a series of questions about the solution invented and finalized with positive feedback and positive comments.

CONTEST OF HYDRAULICS AND PNEUMATICS FOR YOUNG ENGINEERS AND STUDENTS

In the International Salon HERVEX 2011 took place a "Contest of Hydraulics and Pneumatics for Young Engineers and Students".
The contest has enjoyed the participation of a large number of students, master students and PhD. students from several universities, such as: Politehnica University from Timisoara, Technical University of Cluj-Napoca, Technical University "Gheorghe Asachi"- Iasi and Politehnica University of Bucharest.


BROKERAGE

It took place in the second day and the main aim was to gather offers and demands for hydraulic and pneumatic systems, sealing systems, fine mechanics, electronic devices, mechatronics and to find best partners for research projects
The business event pursued to found an open forum for the exchange of technologies ideas and experiences. The participants had the opportunity to access and compare the offers answer and discuss with specialists and potential partners from Romania and Europe.

THE EXHIBITION

Despite all the economic difficulties encountered the, companies which are members of FLUIDAS took part at the event. The companies participated with small stands, showing that our country still has the right potential for surpassing crisis and may contribute significantly at the economic development.

Participants in the exhibition were both companies in FLUID POWER, Research & Development Institutes, Technical Universities and Professional Associations.

• Manufacturers of hydraulic and pneumatic equipments from Romania

HIDROSIB SA, HERVIL SA, HYDRAMOLD SRL, ROMFLUID SA, GENERAL FLUID SA, FAST ECO SA, PRESTCOM SRL, PRIMA ELECTRIC SRL, ADLER ELECTRONIC SRL.

• Representatives of the FLUID POWER companies:

SMC ROMANIA SRL, PARKER HANNIFIN CORP., BIBUS SES SRL, FESTO SRL, HYDAC SRL

• Research & Development Institutes:

ICIA Cluj Napoca, INOE 2000 - IHP, ICTCM SA, TEXAS INSTITUTE OF SCIENCE, INMA Bucuresti, ICPE SA Bucuresti, INCD ECOIND, ICPE-CA BUCURESTI, ICSI-RAMNICU VALCEA, ICMET CRAIOVA, INDMTM BUCURESTI, INSEMEX-PETROSANI

• Professional Associations:

ASOCIATIA INVENTATORILOR DIN ROMANIA - FILIALA VALCEA, ASSOCIATIA PROFESIONALA FLUIDAS, CORPORATION OF HYDRAULIC&PNEUMATIC – POLONIA

PARTICIPATION OF THE PUPILS AND STUDENTS IN HERVEX 2011

This year the International symposium HERVEX 2011 has enjoyed an special interest from the young high school students from the High School "Henry Coanda" who wanted to attend both the official opening and presentation of articles in scientific conferences.

When visiting the exhibition stand of HYDRAMOLD SRL, they received a real lesson of Hydraulics and Pneumatics, from behalf the Associate Professor PhD. Eng. Constantin CHIRITA from Technical University "Gheorghe Asachi"- Iasi.

MASS MEDIA PROMOTION OF THE EVENT

Also, the media promotion through radio, television, newspapers and specialised magazines are known for top achievements of local industry and opportunities for collaboration between various economic units.
From behalf the televisions and radio worth to be mentioned the following: Television from Valcea who has also been present during the entire Symposium, shooting both scientifically and exhibition sessions

Also, the foreign guests from Poland and Germany have interviewed and that have been broadcast by television Valcea 1.

PhD.Eng Heinrich Theissen -
IFAS Aachen, Germania

PhD.Eng Krzysztof KEDZIA –
Wroclaw University of Technology, Poland

The International Symposium HERVEX 2011 was promoted in magazines like: "HIDRAULICA", "PARTENER EUROPEAN" and on-line at : www.hervex.eu, www.ihp.ro, www.ccivl.ro, www.ziare.com, www.fluidas.ro , www.curierul.ro, www.ziare.com

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"HIDRAULICA"

Magazine of Hydraulics, Pneumatics, Tribology, Ecology, Senzorics, Mechatronics

THE POSSIBILITIES OF MODIFICATION OF ENDOPROSTHESIS OF HIP JOINT ACCORDING TO THE USAGE OF HYDRAULIC COMPONENTS

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The hip joint is one, according to the construction, simplest, however also the most loaded joint in human body. It is constructed to transmit the load of 24times the human weight and maximum pressure of 18 MPa.

The hip joint belongs to the group of ball and socket joints. From the physical point of view, it is composed from the femur ending with a head that is set into the socket in pelvis. The connection between this two main members of hip joint is fulfilled by the synovial membrane, that makes a liquid border. Its lifetime is set for the whole human life, which average value is 70 years.

The endprothesis of hip joint is composed from the acetabulum with pad and head connected with stem. The lifetime is approximately 15-20 years.

Fig. 1 Total endoprosthesis of hip joint [8]

The main factors influencing the lifetime of prosthesis are following:

- overloading of prosthesis, f.e. during jumping, jogging...
- abrasion- mostly in the contact acetabulum – head
- telescope- joint leakage, caused by abrasion of contact surfaces of prostheses
- corrosion- reaction of the environment of human body with a foreign material – prosthesis
- lifestyle- inappropriate way of living and increased weight
- the orthopaedic fault- incorrect size or implantation

Physical requirements and properties of human healthy joint

- the coefficient of friction is in the range 0.01-0.1
- the velocity in synovial joints varies from 0.03-0.3 m/s depending on activity
- the volume of synovial fluid in healthy joint varies in range of 0.7-5.6 ml
- concentration of hyaluronic acid in synovial fluid in range 2.5 − 4.7 mg/ml
- the thickness of elastohydrodynamic lubrication layer is app. 1.25-1.3 μm
- the synovial joint are substituted synchronously to sliding and rolling
- healthy joint can withstand a loading up to 24 times the body weight during jumping

The main difference between the endoprothesis and healthy hip joint is missing synovial membrane that make natural border between the head and accetabulum. The main function of synovial membrane is following:

- lubrication
- damping
- nutrition

From physical point of view are for us interesting the first two properties: lubrication connected to the coefficient of friction and wear and damping properties.

Lubrication of diartrodial joints- ball-socket joints

- the distance between head and socket is in the range $5 \leq h \leq 20\mu m$

When we are talking about lubrication of hip joint, we are considering the marginal region filled with synovial fluid, with thicknes in the range $5 \leq h \leq 20\mu m$. The basic condition for movement is that the force F have to be bigger than the sum of normal force Fn and coefficient of friction f. For the human joints is coefficient of friction ranging in $0.01<f<0.1$.

This low coefficient of friction is secured by the permanent lubrication layer of synovial fluid. The lubrication in joints in human body is mostly hydrodynamic, but according to the movement it could change to the thin-layer lubrication and elasto-hydrodynamic lubrication. For example, in the change of movement to the running, the lubrication is changing from the thin-layer lubrication to the

hydrodynamic, and under the certain conditions to the critical, that could even hurt the cartilage. This example demonstrates figure 2.

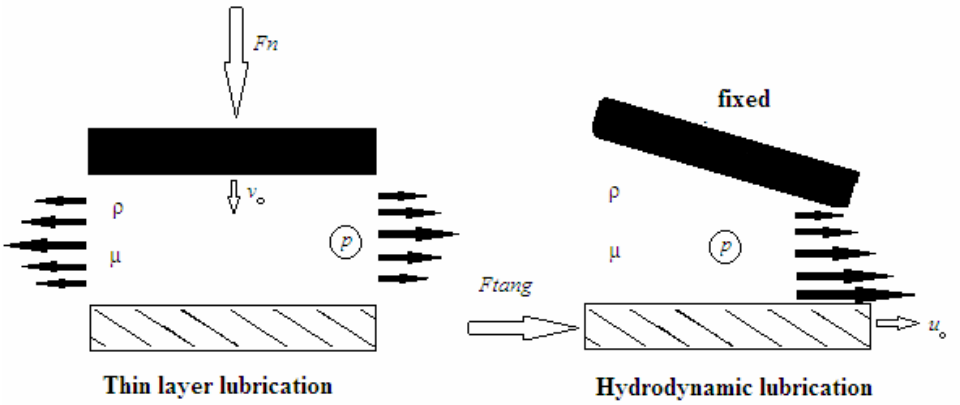

Fig. 2 Thin layer lubrication and hydrodynamic lubrication

Effect of lubrication

As it could be predicted from previous facts, the endoprosthesis of hip joint is not lubricated and so it means that we could observe dry friction, with coefficient of friction around 0.1 (shown in figure 3). However in healthy hip joint coefficient of friction is around 4 times less than in the endoprosthesis.

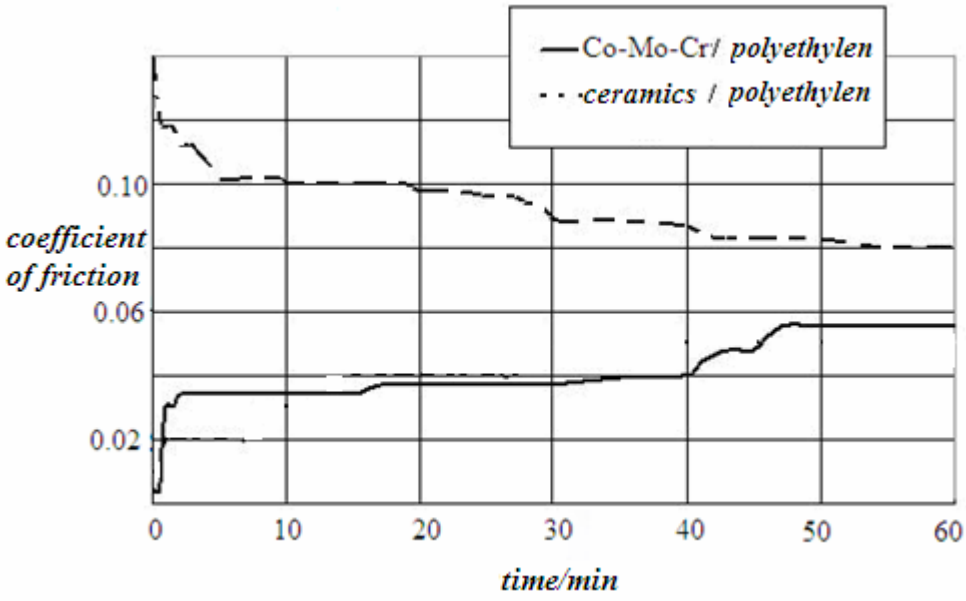

Fig. 3 The value of coefficient of friction in the edoprosthesis of hip joint [10]

Damping properties of diartrodial joints

We have tested analytically the damping properties of synovial fluid. The model of endoprosthesis was simplified to the basic forced-vibration model. From the tables, it is known that the bulk momentum of hyaluronic acid is only in the range of 3-10 kPa, what notices that the hyaluronic acid has to act as a perfect damper. This assumption was confirmed through the model of forced vibration created in Matlab-Simulink. The layer of hyaluronic acid with high of 19x10-7m acts as excellent shock damper as shown in Fig.4.

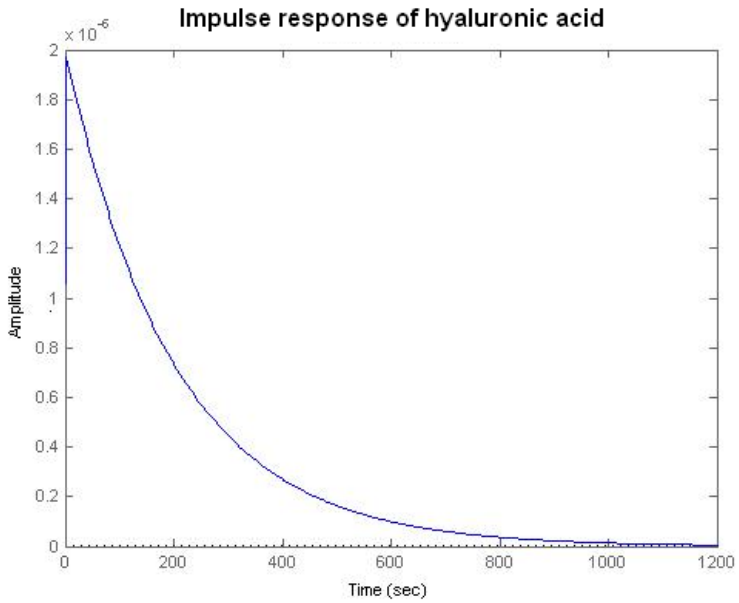

Fig. 4 Impulse response of hyaluronic acid

From these two experiments according to the properties o synovial fluid follows that building up the lubrication into the total hip joint endoprosthesis should decrease the coefficient of friction to the values as it is in the healthy joint, alongside the perfect damping properties. All in all it positively effects wear and loosening of endoprosthesis that could significatelly prolong the lifetime of endoposthesis, what belongs to the most important factors of its usage.

The idea for modification of endoprosthesis

The basic idea of modification, using hydraulic components is based on the used model of endoprosthesis modified for telemetry and medical solution of the beginning orthopaedical problems-injection of fluid simulating the effect of synovial fluid, a fluid that is in the health joint acting as lubricant.

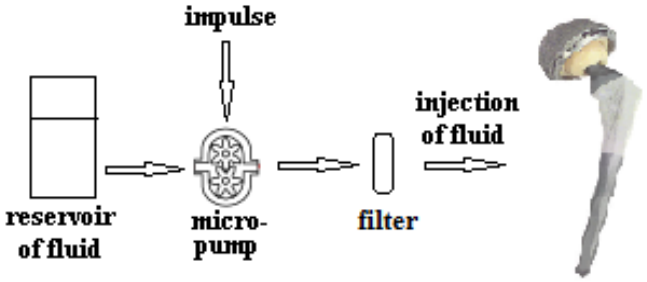

Fig.5 Hypothetic scheme of hydraulic system acting in the endoprosthesis

The lubrication would be supported by hydraulic circuit, and would function as additional system. Injected fluid should simulate the effect of the original synovial fluid - to act as a damper (to prevent overloading) and balancing element (to prevent abrasion and subsequent telescope) and would not aggressively react with the human body environment, as well as with prosthetic material.

The fluid injection system would be the additional system in case of overloading or increased friction in the acetabulum of the hip joint endoprosthesis. The main damping effect would consequently remain during the conditions, that do not reach the risky - boundary values, from the main effect of polyethylene pad of the acetabulum.

Conclusion

As the endoprosthesis of hip joint is nowadays common orthopaedical operation, even in cases of people under 40, the question of lifetime is very important. Consequentelly, in the next steps, we would like to make experiments that would confirm the information stated in this text followed by the real model of modification of endoprosthesis.

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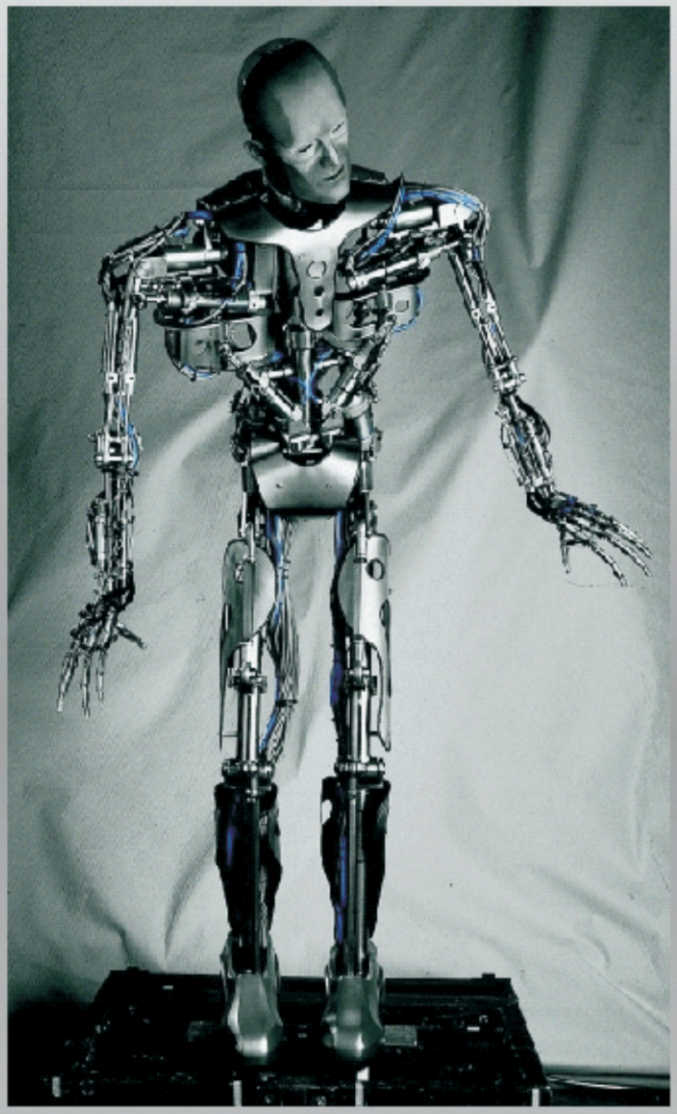

- Componente, module şi sisteme pneumatice: cilindri pneumatici, motoare pneumatice, elemente şi sisteme de manipulare şi poziţionare, senzori şi accesorii pentru cilindri şi motoare, distribuitoare cu comandă manuală, mecanică, pneumatică, electrică, componenete pentru automatizări pneumatice, elemente şi accesorii pentru vacuum, elemente proporţionale, elemente de filtrare, reglare şi ungere aer, racorduri şi tuburi
- Senzori de proximitate şi fotoelectrici
- Automate programabile
- Calculatoare de proces industriale
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EXPERIMENTAL RESEARCH REGARDING THE DYNAMIC BEHAVIOR OF LINEAR HYDRAULIC MOTORS IN FREQUENCY DOMAIN

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Abstract: *This article presents the results of an experimental research regarding the dynamic behavior of linear hydraulic motors, in the frequency domain, which took place in INOE 2000-IHP, in the framework of the NUCLEU Program. The research has been conducted in experimental mode. The experimental investigations were conducted on an experimental stand with data acquisition and computer processing. The paper presents some experimental results obtained in the research, results that are of real scientific interest, and, also, have practical value through their use in the design of fluid power components and equipment*.

Keywords: linear hydraulic motors, dynamic behavior, experimental research, *frequency domain,*test stand, sensors and transducers, data acquisition system.

1. INTRODUCTION

Linear hydraulic motors, which are the subject of research presented, are operative hydraulic elements that perform a linear motion at the working mechanism of equipment and machinery. These operative elements have as their characteristic the rectilinear motion and they are currently known as *hydraulic cylinders*, or servo cylinders, or hydraulic linear actuators [1].

Servo hydraulics is a complex, interdisciplinary science and it is a system technique itself.

Linear positioning electro hydraulic servomechanisms represent just one special class of these automatic hydraulic linear systems, and they consists in principle of an *adjustment device*, which consists of the regulator that contains a comparator and an amplifier, as well as a *hydraulic servo cylinder*, consisting of a hydraulic cylinder, an electro hydraulic servo valve and, also, a position measuring system. Displacement sensors, existing in the structure of linear hydraulic positioning servo systems, have a critical role in performing the automatic adjustment of the desired and programmed position. The precision that positioning servo system ensures can not be greater than the precision of the position measuring system [2].

Therefore, research on dynamic behavior and, above all, testing of the stability and positioning accuracy of these electro hydraulic servo systems should be made in accordance with specific procedures, they having a decisive influence on the functioning of equipment to which they belong

Frequency domain analysis has several advantages over time domain analysis, especially for precision attitude tracking tasks. Time domain data collected by step, doublet, or pulse inputs, are sensitive to slight variations in the shape of the control input [3] . Frequency domain analysis, on the other hand, is relatively insensitive to input shaping, especially at the higher frequency end. Another advantage of frequency domain analysis is that it is suitable for stable or unstable systems,

Frequency-domain approaches use spectral analysis methods to extract the frequency responses between selected input and output pairs after exciting the system with a selected input frequency sweep. Bode plots are used for presenting results, that is, magnitude in decibels (dB) and phase shift in degrees versus log-frequency.

In addition to theoretical research of dynamic behavior [4], a substantial role is played by experimental research, designed to confirm, based on *experimental measurements*, *the actual*

performance of the dynamic behavior of hydraulic operative elements. To experimentally test the linear hydraulic motors in order to investigate the factors that influence the dynamic behavior of linear hydraulic motors (MHL), there has been necessary to design and construct an experimental test stand, which allowed conducting experimental research in good condition. The test stand was developed inside of the *Laboratory of Servo-Control Equipments* from INOE 2000-IHP, this having at disposal modern methodologies of research for the dynamic behaviour, based on using some performant experimental softwares for the dynamic systems, LabVIEW and TEST POINT, in order to find the dynamic responses of this modern servosystems.

2. THE PRESENTATION OF THE STAND AND THE OBJECT OF THE RESEARCH

For performing the experimental research regarding the dynamic behavior of the linear hydraulic elements, in the frequency domain, were chosen as objects of study a linear hydraulic motor with bilateral rod, commanded by means of a servovalve, placed horizontally and loaded with different inertial masses, being intended to measure and record the dynamic response in the frequency field, of the electrohydraulic drive linear system realized [5].

The experimental stand for studying the dynamic behavior of the linear hydraulic motors developed within the Laboratory of electrohydraulic regulation elements from INOE 2000 IHP, on the structure of an existent stand for testing hydraulic prompts. This comprises a servoactuator produced by MOOG consisting of a hydraulic cylinder with bilateral rod, which is in fact a hydraulic performing element with linear movement, mounted in horizontal position and which is commanded supplied by means of a servovalve together making a hydraulic system with linear motion, figure1. The under pressure oil supply is made from a hydraulic pressure unit with manually adjustable flow and the possibility of measuring the flow. The hydraulic system with linear motion composed of the linear hydraulic motor and servovalve is in fact the object to be tested for finding out the dynamic behavior of the linear hydraulic motors in the frequency field.

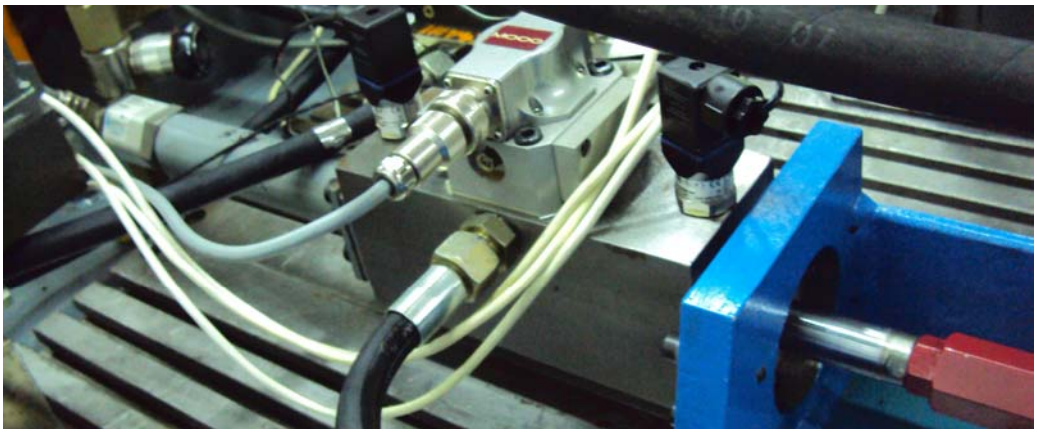

Fig. 1 the linear servomotor to be tested

For loading the linear hydraulic motor was used a load device which consists of an oscillating mechanism mounted on the rod of the linear hydraulic motor. The device shown in figures 2 and 3 performs an oscillating motion at the displacement of the rod [6].

Fig. 2 The work mechanism without load

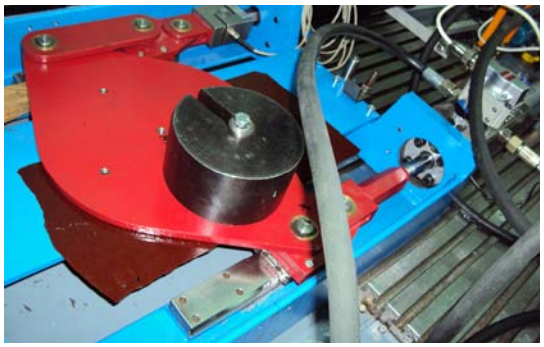

Fig. 3 The work mechanism with load

2.1.The scheme of the experimental assembly for dynamical testing

The scheme for the dynamical testing of the linear hydraulic motor is shown in figure 4 and is made in AUTOCAD 2007, and its composition is described below.

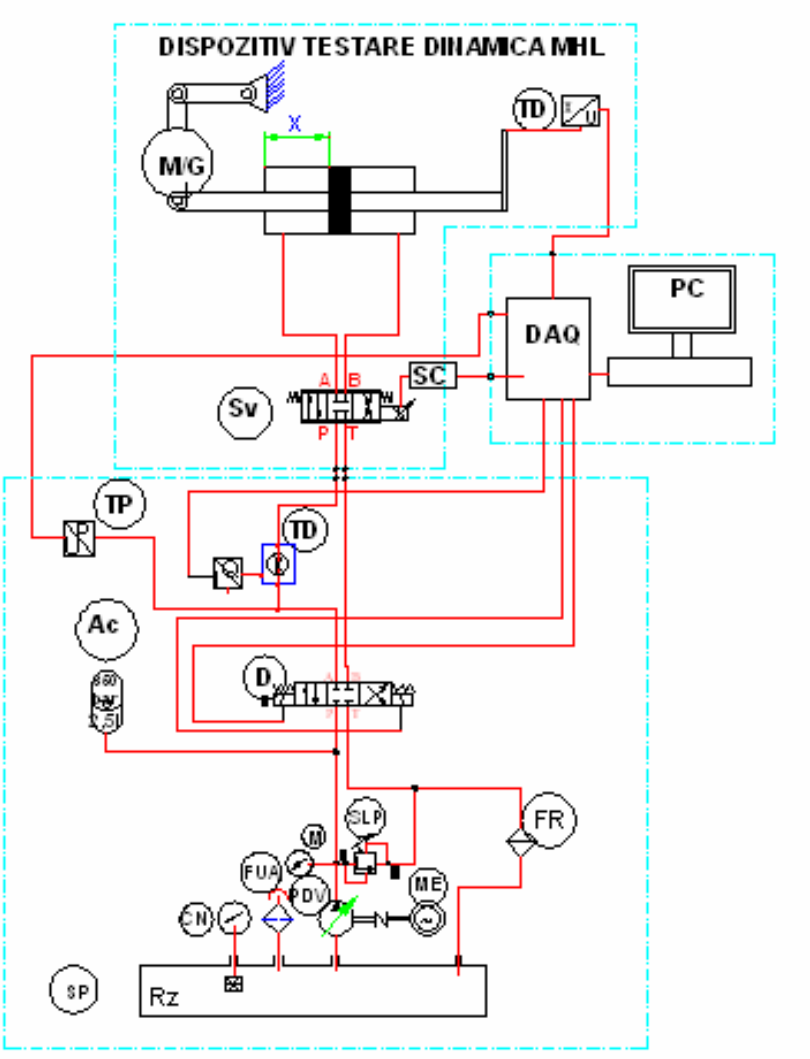

Fig. 4 The testing scheme of the linear hydraulic motor, in frequency domain

The main components of the assembly for dynamic testing in the frequency field according to the scheme shown in figure 4 are the following:

- The dynamic testing system or device consisting of a linear hydraulic motor MHL and a servovalve SV, commanded by the servocontroller SC;
- The stroke / displacement transducer TD, which converts displacement x in tension U;
- The mass/weight of the load piece M/G;
- Pressure transucers TP converting the pressure of the fluid into tension U;
- Hydropneumatic accumulator AC;
- **Pressure station SP** composed of typical elements mounted on an oil reservoir Rz:
- Filling aering filter FUA;
- Pump with variable flow PDV;
- Electric motor ME;
- Level controller CN;
- Valve for limiting pressure SLP;
- Return filter FR;
- Electric power distributor D;
- Flow transducer TQ, which converts flow into current I;
- Data acquisition and processing system SAD consisting of the data acquisition plate PAD and the computer PC;

From the above figure 4, is noticed that the scheme of dynamic testing of the linear hydraulic motor comprises three main subassemblies:

- Pressure station
- The lineary operating hydraulic device or system;
- Data acquisition system

The pressure station SP supplies an adjustable flow of oil under pressure and has all the elements specific for the usual pressure groups inclusively flow transducer TQ and pressure transducer TP.

The lineary operating hydraulic device or system comprises the linear hydraulic motor MHL and the servovalve SV. The system is provided with the transducers necessary for seizing the evolution of the parameters of interest the stroke transducer TD incorporated and servocontroller for the command of the valve.

The hydraulic system of execution with linear motion, consisting of the linear hydraulic motor and the servovalve, is the object to be tested for finding out the dynamic behavior of the linear hydraulic operating elements, in the frequency field.

The data acquisition and processing system consists of the data acquisition plate DAQ, the computer PC and the stroke transducer TD, operating by means of some sofware for data acquisition and processing.

The loading of the operating system is made placing the arm of the mechanism driven by the rod of the linear hydraulic motor of some pieces with different loads weights but known M and G. In this way, is created the work load of the hydraulic motor.

2.2.The physical accomplishment of the testing assembly MHL in the frequency field

At the design and physical accomplishment of the experimental stand for studying the dynamic behavior of the lineary hydraulic, operating elements was taken into account mainly the optimum utilization of the existent endowment with a minimal purchasing of certain device and components for facilitating the research in conditions of crisis.

The physical accomplishment of the stand is shown in figures 5-12.

In the figures 5 and 6 is presented the testing stand in two general views: in figure 5 are presented the pressure station and in figure 6 are presented the displaying panel and data acquisition system.

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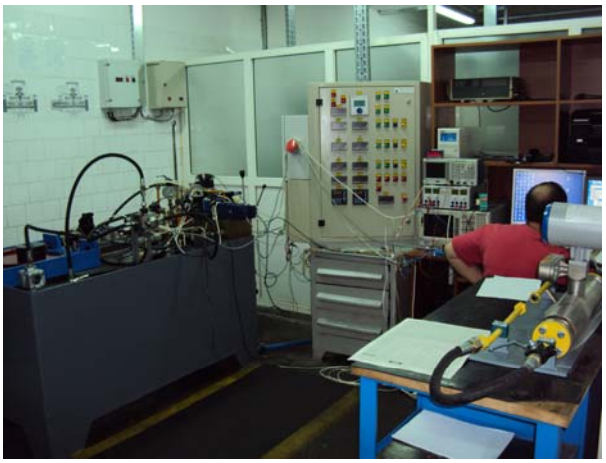


Fig. 5 The gneral view of the stand- the pressure station and the display board

Fig. 6 The general view of the stand- the display board and the data acquisition and processing system

In Figure 7 is presented the testing device and in Figure 8 the tested linear hydraulic servosystem. The servovalve and the linear hydraulic motor are presented in Figure 9 and the incorporated displacement transducer of the servosystem in Figure 10.The adjustment of the working flow and working pressure are presented in Figure 11, for exemple adjustment of pressure to 65 bar and flow to 20 l/min like in Figure 12.

Fig. 7 The testing device

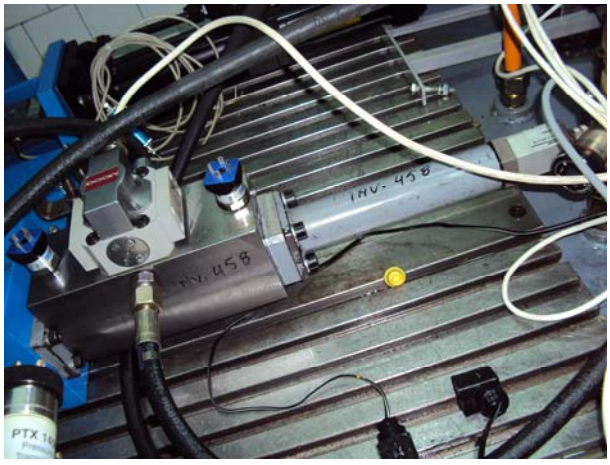


Fig. 8 The tested linear hydraulic servosystem

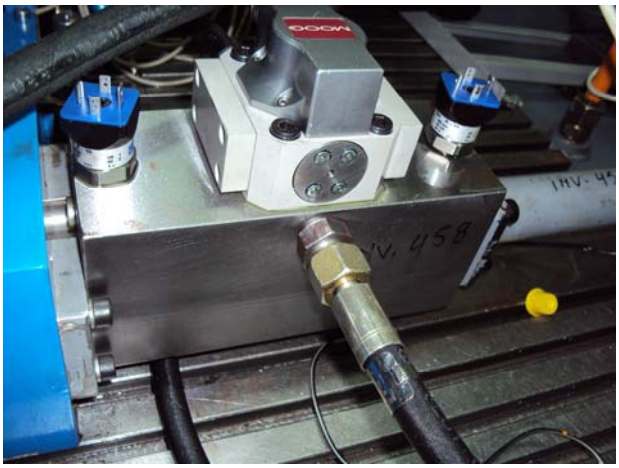


Fig. 9 The servovalve and the linear hydraulic motor

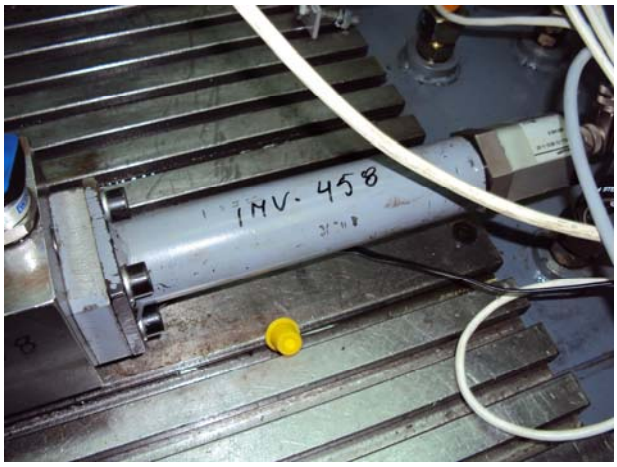


Fig. 10 The incorporated displacement transducer

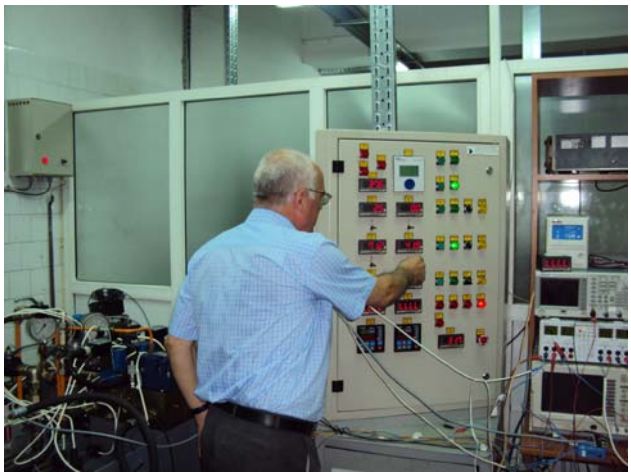


Fig. 11 The working flow and pressure adjustment

Fig. 12 Adjustment of pressure to 65 bar and flow to 20 l/min

2.3. The development of the experiments regarding the dynamic behavior

The development of the experiments regarding the dynamic behavior of the linear hydraulic motors had at its base a *Testing program*

The method of wok

The study of the dynamic behavior of the linear hydraulic motors implies the knowledge of the variations in frequency of the dynamic parameters of interest At the command of the servovalve with a signal of constant amplitude and variable frequency, by monitoring the variation of the stroke of the rod, was obtained the answer in frequency of the dynamic behavior of the linear hydraulic motor to be tested. For this, after preparing and accomplishing the technical conditions of operation required for the optimum work of the experimental stand, were followed the below mentioned steps:

- Were placed, on turns, different masses with the weight G on the mechanism mounted on the rod of the linear hydraulic motor, which represent its load;
- Were adjusted different values of pressure and flow for supplying the servovalve;

- Was ordered the servovalve for driving the hydraulic motor, with different signals of constant amplitude, but with increasingly variable frequencies;
- Were measured and recorded, by means of the data acquisition system, the variation of the parameters of interest, namelly the variation of the command signal and of the stroke position of the rod;
- Was obtained the dynamic response of the tested system, by superposing the two parameters of interest; in the form of numeric or graphic variations;
- Were analized the values and graphic evolutions of the parameters of interest.
-

The technical data of the linear hydraulic operating system
The system consisting of a linear hydraulic motor and its servovalve had the following technical characteristics:

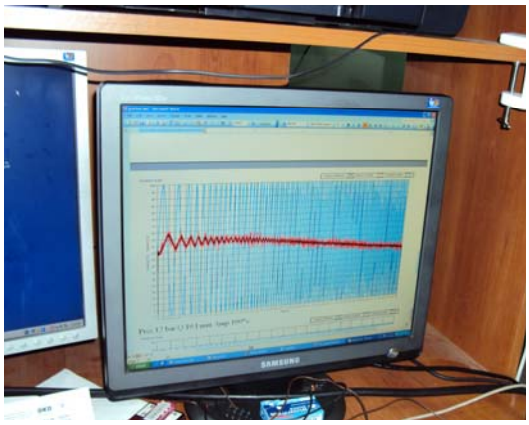
The technical data of the linear hydraulic motor
- Type: hydraulic cylinder with bilateral rod;
- Cylinder dyameter: 1,55 in 40 mm;
- Rod dyameter: 25,4 mm;
- The surface of the piston: 1,1 in^2-mm^2;
- The operational stroke: 6 in 152,4 mm;
- Max operational ressure: 250 bar.

Technical data regarding the servovalve
- The type of servovalve: MOOG (seria A085);
- Pressure: 70 bars;
- Nominal dyameter: 6 mm;
- Max flow: 40 l-min.

Technical documentation which represented the base for the tests
The technical documentation was the testing scheme shown in Figure 4 and *Testing program.* Were, also, used technical data provided by the manufacturer MOOG, for Servoactuators (seria A085), including the hydraulic cylinder and the servovalve (seria 760) documentation.
The tests were carried on according to the requirements from the *Testing program* which comprised the following tests:

2.4. The experimental results obtained

By testing the hydraulic servosystem was intended to be found the dynamic response of the system in the frequency field
Were performed a series of tests, which consisted in the transmission of some commands of constant amplitude and variable frequency and was intended to find the dynamic response of the system, in the frequency field. The tests were performed in the conditions of a constant flow and pressure at servovalve, with or without, load mass weight at the work mechanism
The tests were performed for various pressures and flows at servovalve, and the prompts were given in procentual grades from the max.amplitude: 100% , 50%, 25% , and was intended to observe the evolution of the dynamic response.
All tests were recorded and presented in graphical form, Figure 13 and Figure 14



Fig, 13 The display of computer

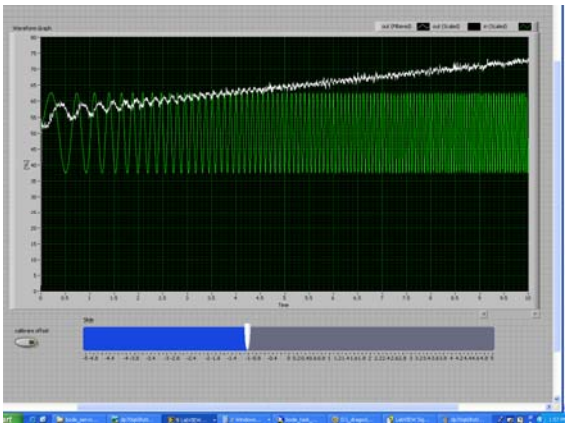


Fig. 14 The panel of graphics

The synthesis of the performed tests is shown in table 1 below:

Table 1

		First series			Second series			Third series	
Amplitude [%]	25	50	100	25	50	100	25	50	100
Flow Q [l/min]	40	40	40	19	19	19	10	10	10
Pressure [bar]	70	70	70	65	65	65	12	12	12

As a results of the experiemntal research developed and focused on the dynamic behavior of the linear hydraulic motors, in the frequency field, were obtained a series of graphic and table results regarding the variation, in frequency, of the main operational parameters of the tested system:

- The variation of the rod stroke: x=x(t);
- The variation of the command signal, of constant amplitude and variable frequency;
- The variation, in frequency, of the dynamic response of the tested hydraulic system;

These variations of the dynamic parameters were obtained in the following conditions:

- A constant flow at the servo valve;
- A constant pressure at the servo valve;
- A command signal of constant amplitude, equal with a percentage from its max value;
- With, or without, load at the work mechanism.

In the following figures fig.15, 16, 17 are shown the graphic variations of the dynamic parameters in the frequency field obtained in the following conditions:
- Fig.15, for pressure 70 bar, the flow Q = 40l/min and signal amplitude 100%;
- Fig.16, for pressure 70 bar, flow Q=40 l/min and the amplitude of the signal 50%;
- Fig.17, for pressure 70 bars flow Q=40 l/min and the amplitude of the signal 25%;

All the test were performed without load at the work mechanism M= 10 kg.

In the following figures fig.18, 19, 20 are shown the graphic variations of the dynamic parameters in the frequency field obtained in the following conditions:
- Fig.18, for pressure 12 bar, the flow Q = 10l/min and signal amplitude 100%;
- Fig.19, for pressure 12 bar, flow Q=10 l/min and the amplitude of the signal 50%;
- Fig.20, for pressure 12 bars flow Q=10 l/min and the amplitude of the signal 25%;

All the test were performed without load at the work mechanism M= 00 kg.

a) The dynamic response at the test with load, with pressure 70 bar and flow 40 l/min

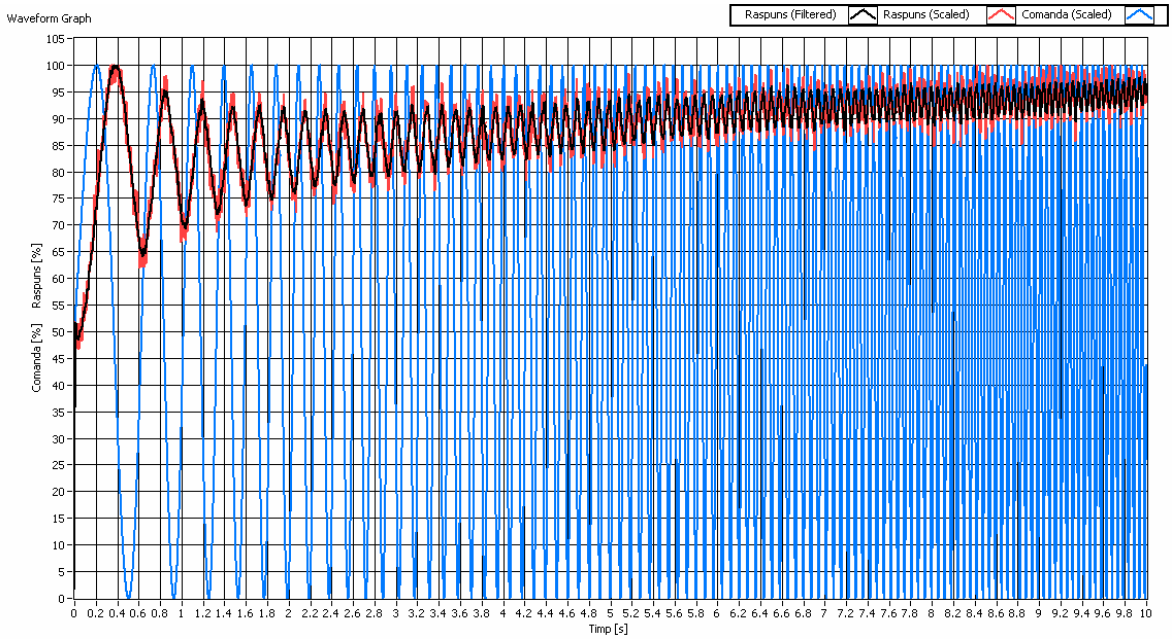


Fig.15 The dynamic response in frequency at the amplitude command 100%

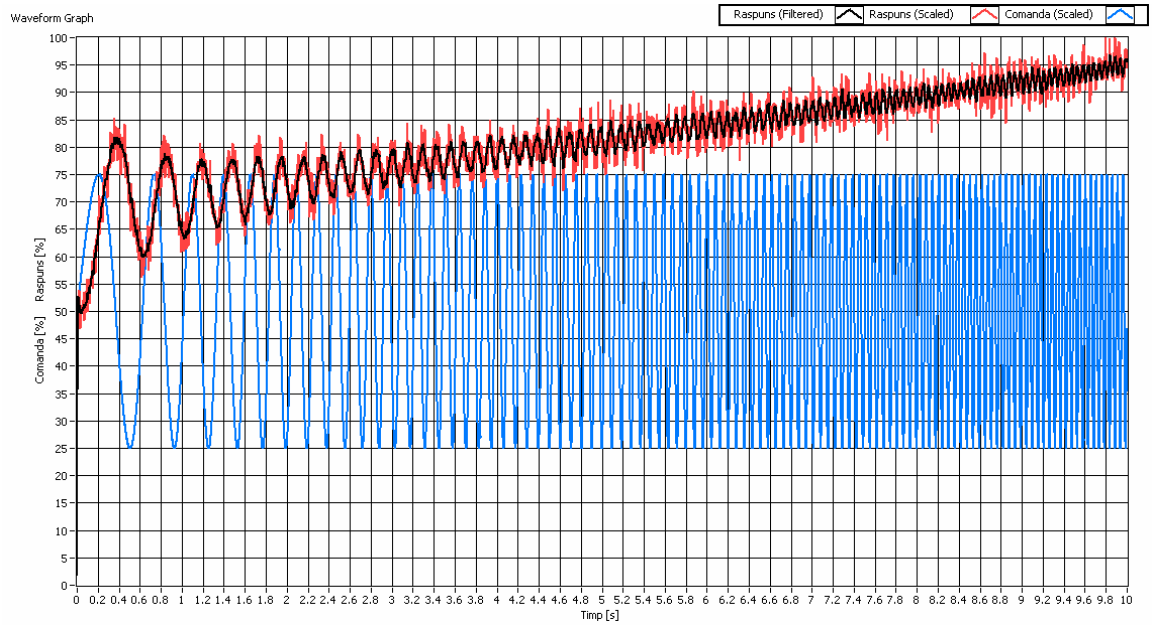


Fig.16 The dynamic response in frequency at the amplitude command 50%

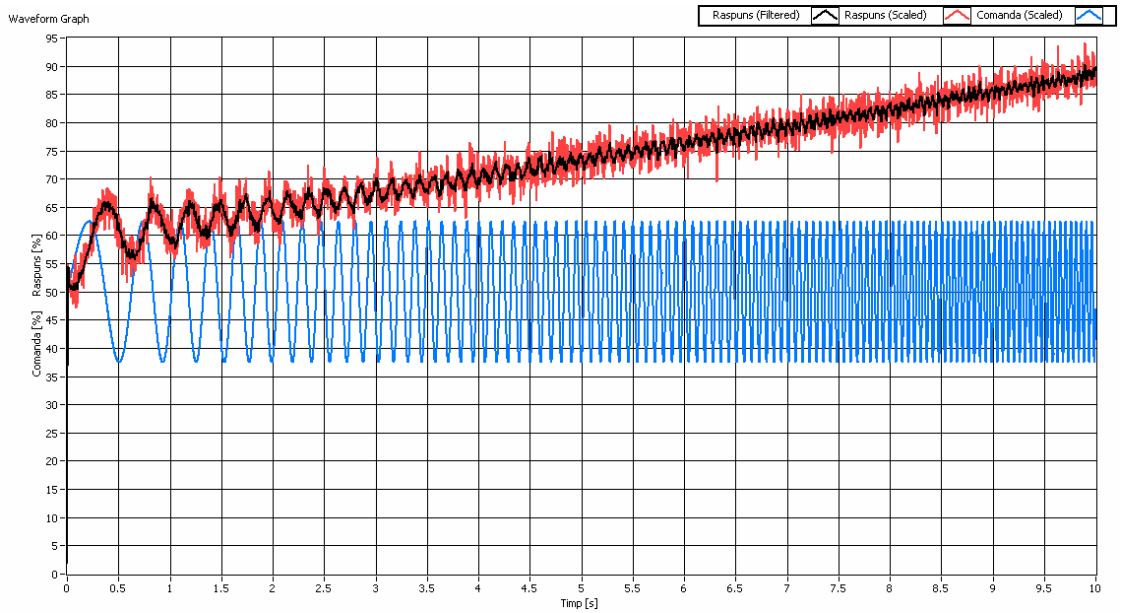


Fig.17 The dynamic response in frequency at the amplitude command 25%

b) The dynamic response at testing with load, with pressure 12 bar and flow 10 l/min

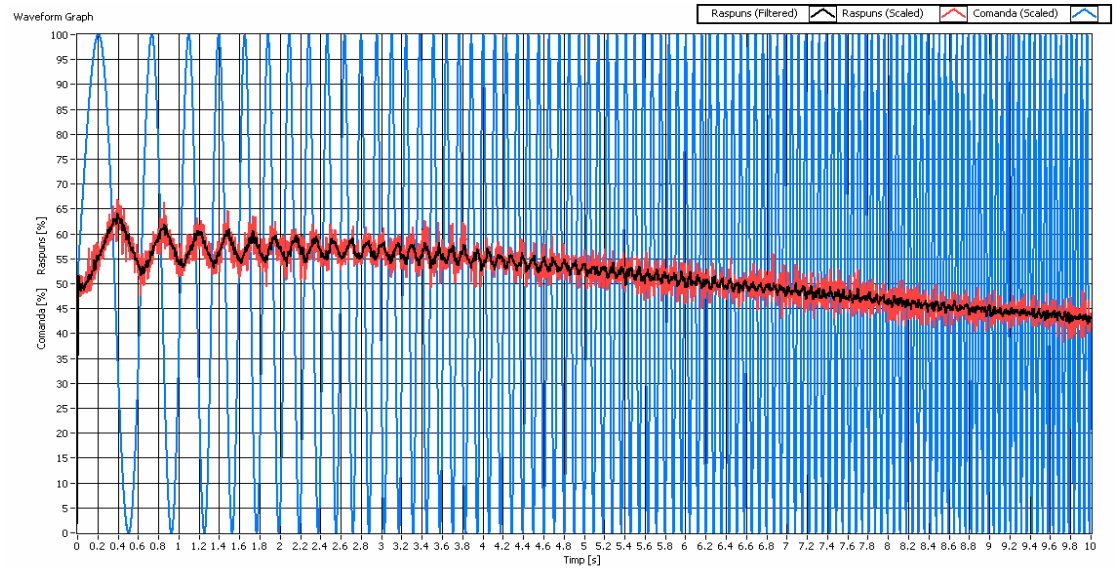


Fig.18 The dynamic response in frequency at the amplitude command 100%

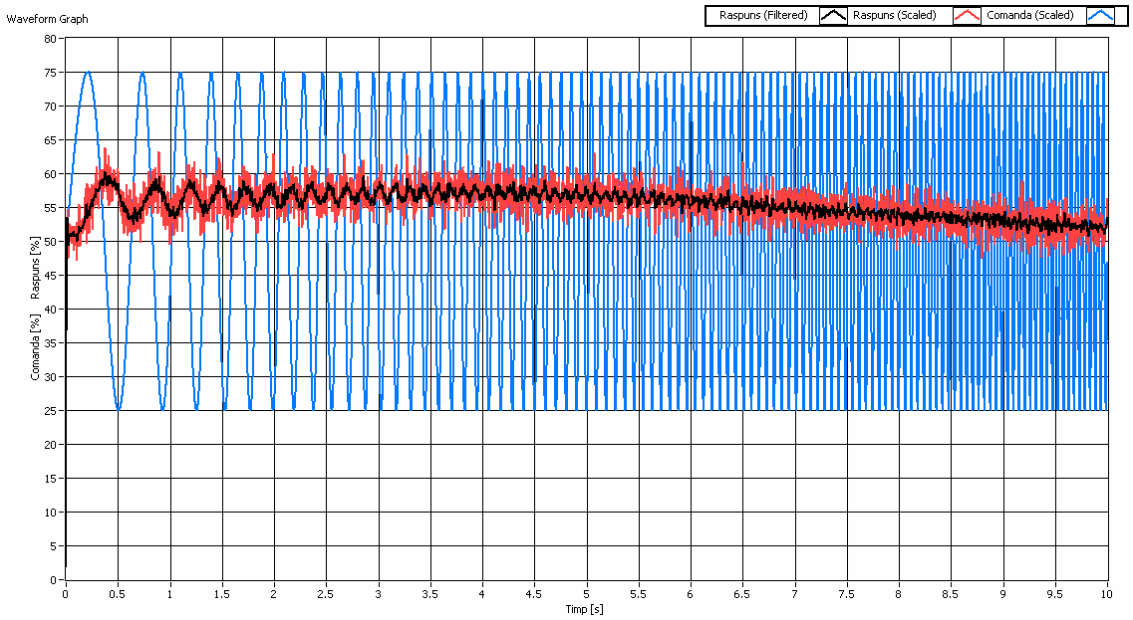


Fig.19 The dynamic response in frequency at the amplitude command 50%

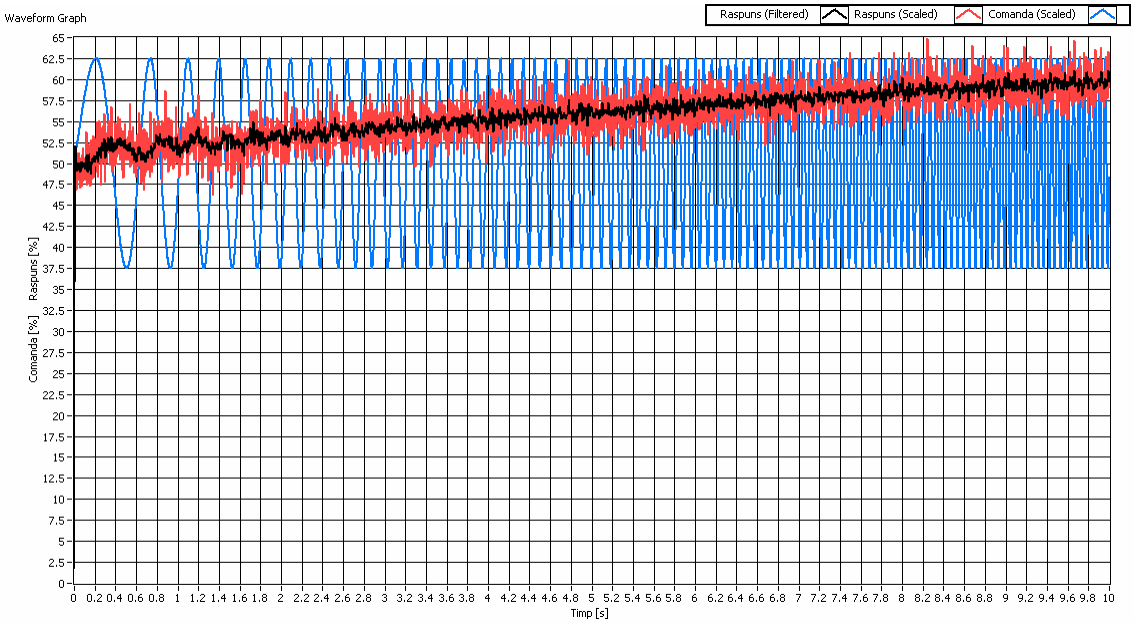


Fig.20 The dynamic response in frequency at the amplitude command 25%

3. CONCLUSIONS AND RECOMMENDATIONS

3.1. Conclusions

The experimental research performed validated the constructive solutions chosen for the testing stand of the dynamic behavior of the linear hydraulic servomotors, in the frequency field, and the testing method proposed for finding the main factors which influence this behavior.
Were performed four series of measurements: 3 series with load at the work mechanism of the servosystem and 1 series without load at the work mechanism.
Each series of measurements consists of three consecutive determinations, each one in the same conditions of flow and pressure, with the amplitude of the signal constant representing a certain percentage from the max.value: 100%, 50% 25%.
The test flows were the following: 40 l/min 20 l/min, 10 l/min.
The external load at the mechanism of the linear hydraulic motor was of 10 kg.
By comparing the graphics realized with and without load results a slight behavioral difference between them.
From the analysis of the graphics, it is noticed a tendency of accession of the response in frequency, which is explained by the sliding changing of the oscillating position of the piston, as a probable result of the leaks caused by adjusting the slide.
The experimental research regarding the dynamic behavior of the linear hydraulic motors in the frequency field made possible the quantitative and qualitative determination of the behavioral response of the tested system.

3.2. Recommendations

After making the comparative analysis of the graphic results obtained it resulted as necessary the continuation of the experimental research especially for bigger loads, comparable with the maximum load of the liniar hydraulic motor chosen for knowing and putting into evidence which is the real relation between load and the dynamic respose of the system. For maintaining the oscillating position of the piston must be made a reaction loop by which to be controlled this position. It is necessary the completion of the software for processing data with a subroutine which to supply the BODE diagram for allowing the study of the dynamic behavior of the linear hydraulic motor directly on its basis.

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ANALYTICAL MODEL AND NUMERICAL SIMULATION OF THE ALTERNATING FLOW DRIVEN THREE-PHASE HYDRAULIC SYSTEMS

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Abstract: *The paper presents the specific equations that are defining the transfer functions of the components and finally the system transfer function, determined based on each component specific characteristics, of the alternating flow driven three-phase hydraulic systems. Also there are presented the relations which are defining the shape of the output signal from each element, so as the evolution theoretical diagrams of the motor pistons stroke amplitude, considering different masses of them or distinct values of the oil column rigidity from the connection pipes.*

Keywords*: analytical model, alternating flow, three-phase hydraulic system*

1. General aspects

Alternating flow driven systems involves a new approach of the driving systems using pressurized liquids, because we have here, in the entire system, along the pipes, an energy transmissions without volumetric flow transportation between the energy converters, hydraulic generator and hydraulic motor. [2], [4], [5]

The classical solutions of hydraulic systems imply a unidirectional flow of the fluid through pipes between the energy converters. The hydraulic transmission using alternating flows is based on the bidirectional displacement of a predefined volume of fluid through the connection pipes between the alternating flow and pressure energy generator and the motor. Within these systems, the active stroke of the hydraulic motor pistons, is produced by the pressurized fluid flow from the generator, while, for the retraction stroke there is necessary a supplementary connection (in a star or delta configuration) to a pressure generator, working in opposite phase with respect to the first one. [3]

Generally, an alternating flow driven hydraulic transmission consists in a alternating flows and pressures generator (G) and a motor (M), the connection between them being realized with a number of pipes equal with the number of phases (Phase 1, Phase 2 and Phase 3), the pipes being filled with fluid at a certain (pre-established) pressure, figure 1. During the functioning of the system the pressure and the flow within each pipe varies in a sinusoidal way, around an average value.

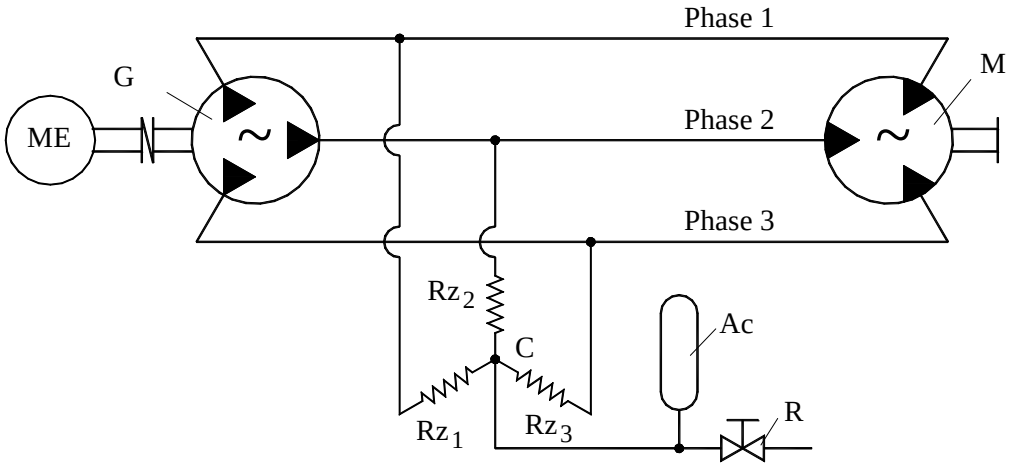

Fig. 1. Principle schema of an alternating flows and pressures drive hydraulic system.

In order to have a proper functioning it is compulsory that this average pressure from each pipe to have the same value and to have a constant value in time. Therefore, to obtain the correct functionality we create from the beginning either a pressure in each phase, higher than the amplitude maximum value, or this pressure is modifying itself during the functioning.

This result is obtained by using both a series of hydraulic resistances (Rz_1, Rz_2, Rz_3) rigorously calculated which interconnect all the phases and a hydraulic accumulator (Ac) connected to them in to the point C, figure 1. The resistances must eliminate the maximum average pressure rising value in one second when the diminution of the flow amplitude from a phase does not exceeds 1%. [7]

The accumulator presence makes the pressure in a connection to be all the time approximately constant, it being able to take over the oil surplus from the dilatations and in the same time to complete the eventually oil loses. [2]

2. Simplified analytical model of the alternating flow driven three-phase hydraulic systems

The precision of the analyzed aspects, the design and the physical realization of an automatically system depends on the complete modeling possibilities, using characteristic equations for each component. It is also very important the correct determination of each constant value from the equations structure which involve the establishment of the frequency functions.

The transfer functions of the elements (components) represent the rate between the Laplace transformations of the output respectively input signal, for null initial conditions.

The general effect of using the Laplace transformation is the reducing of difficulty order of the problems. The transfer function algebra contains some rules which allow combining the transfer functions of many components and finally to obtain the transfer function of the entire assembly of individual elements. [1]

The transfer function of the entire system was determined considering that the input signal is a harmonic one (sinusoidal), signal provided by alternative movement of the hydraulic generator piston, and the output signal is a hydraulic motor piston displacement, also harmonic, but having an amplitude and phase angle alteration. [2], [6]

The dynamic system schema is represented in figure 2.

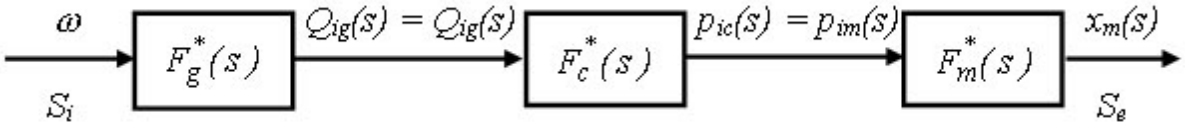

Fig. 2. Alternative flow driven dynamic system representation.

in which:

$F_g^*(s)$ - hydraulic generator transfer function;

$F_c^*(s)$ - hydraulic pipe transfer function;

$F_m^*(s)$ - hydraulic motor transfer function;

$Q_{ig}(s)$ - instantaneous flow at the hydraulic generator output;

$Q_{ic}(s)$ - instantaneous flow at the input of the pipe;

$p_{ic}(s)$ - instantaneous pressure at the output of the pipe;

$p_{im}(s)$ - instantaneous pressure at the hydraulic motor input.

We can notice that: $Q_{ig}(s) = Q_{ic}(s)$ and $p_{ic}(s) = p_{im}(s)$.

The output signal, hydraulic motor piston stroke, is defined by the equation:

$$x_m(t) = \left|F_g^*(t) \cdot F_c^*(t) \cdot F_m^*(t)\right| \cdot \sin(\omega t + \varphi_0 + \psi_c + \psi_m) \tag{1}$$

where:

$\left|F_g^*(t) \cdot F_c^*(t) \cdot F_m^*(t)\right|$ - transfer function modulus of the hydraulic generator, motor an pipe;

ψ_c - phase alteration angle between the output and input of the pipe;

ψ_m - phase alteration angle between the output and input of the hydraulic motor;

Instantaneous flow provided by the hydraulic generator is defined by the equation:

$$Q_i = Q_{a\max} \cdot \sin(\omega t + \varphi_0) \tag{2}$$

in which, the instantaneous flow amplitude is:

$$Q_{a\max} = \omega \cdot \frac{x_g}{2} \cdot S_g \tag{3}$$

and the instantaneous pressure is:

$$p_i = p_{a\max} \cdot \sin(\omega \cdot t + \varphi_0) \tag{4}$$

Using the Laplace transformation on the relation (2) and (3) the transfer function of the hydraulic generator is:

$$Q_i(s) = \frac{1}{2} \cdot x_g \cdot S_g \cdot \frac{\omega^2}{s^2 + \omega^2} \tag{5}$$

The combined effect of the friction, inertia, hydraulic capacity and hydraulic losses, can be expressed by summing the corresponding instantaneous pressures.

In this way, the transfer function of the hydraulic pipe is defined by the equation:

$$F_c^*(s) = \frac{L \cdot C_h \cdot s^2 + \left(C_f + \frac{1}{C_P}\right) \cdot C_h \cdot s + 1}{C_h \cdot s} \tag{6}$$

The presence of the hydraulic accumulator in the system will compensate the hydraulic volumetric losses and the transfer function of the hydraulic pipe can be rewritten as:

$$F_c^*(s) = \frac{1}{s} \cdot \left(L \cdot s^2 + C_f \cdot s + \frac{1}{C_h}\right) \tag{7}$$

The hydraulic motor piston can be regarded like a mechanical oscillating system, and in this case, the equation defining the hydraulic motor transfer function is:

$$F_m^*(s) = \frac{x_m(s)}{p_{im}(s)} = \frac{S_m}{k_{ulei}} \cdot \frac{1}{\frac{m_{tot}}{k_{ulei}} \cdot s^2 + \frac{C_f}{k_{ulei}} \cdot s + 1} \tag{8}$$

Considering the transfer functions of the hydraulic generator, pipe and hydraulic motor, the equations (5), (6) and (8), being a series connection, figure 1, then the transfer function of the entire system can be determined by multiplication of the functions of each element:

$$F_{tot}^{\ *}(s) = F_g^{\ *}(s) \cdot F_c^{\ *}(s) \cdot F_m^{\ *}(s) \tag{9}$$

resulting:

$$F_{tot}^{\ *}(s) = \frac{\omega \cdot x_g \cdot S_g \cdot S_m}{2 \cdot C_h} \cdot \frac{L \cdot C_h \cdot s^2 + C_{f1} \cdot C_h \cdot s + 1}{s \cdot \left(m_{tot} \cdot s^2 + C_{f2} \cdot s + k_{ulei}\right)} \tag{10}$$

By replacing $s = j \cdot \omega$ in equation (10) and considering $j^2 = -1$, the modulus of the transfer function of the entire system will be:

$$\left|F_{tot}^{\ *}(j\omega)\right| = \frac{\omega \cdot x_g \cdot S_g \cdot S_m}{2 \cdot \left[C_{f2}^2 \cdot \omega^4 + \left(m_{tot} \cdot \omega^2 - k_{ulei}\right)^2\right]} \cdot$$

$$\cdot \sqrt{\left(\omega^3 \cdot L \cdot C_{f2} + \omega^2 \cdot m_{tot} \cdot C_{f1} + k_{ulei} \cdot C_{f1}\right)^2 + \frac{\left[\omega^3 \cdot C_h \cdot \left(\omega \cdot L \cdot m_{tot} + C_{f1} \cdot C_{f2}\right) - \omega^2 \cdot \left(m_{tot} + k_{ulei} \cdot L \cdot C_h\right) + k_{ulei}\right]^2}{C_h^2}} \tag{11}$$

and the phase alteration:

$$\psi_{tot} = arctg\left[-\frac{1}{C_h} \cdot \left(\frac{\omega^3 \cdot C_h \cdot \left(\omega \cdot L \cdot m_{tot} + C_{f1} \cdot C_{f2}\right)}{\omega^3 \cdot L \cdot C_{f2} + \omega^2 \cdot m_{tot} \cdot C_{f1} + k_{ulei} \cdot C_{f1}} - \right.\right.$$

$$\left.\left. - \frac{\omega^2 \cdot \left(m_{tot} + k_{ulei} \cdot L \cdot C_h\right) + k_{ulei}}{\omega^3 \cdot L \cdot C_{f2} + \omega^2 \cdot m_{tot} \cdot C_{f1} + k_{ulei} \cdot C_{f1}}\right)\right] \tag{12}$$

In figure 3 and figure 4 are presented the theoretical diagrams of the hydraulic motor piston strokes, obtained by numerical simulation, using the equation (11), for different motor piston masses, respectively, different values of the oil column rigidities, k_{oil}.

Those representations shows that the amplitude of the hydraulic motor piston strokes is decreasing with the piston masses and oil column rigidity increasing, but the resonance frequency point is lower in the first case, figure 3, and bigger in the second case, figure 4.

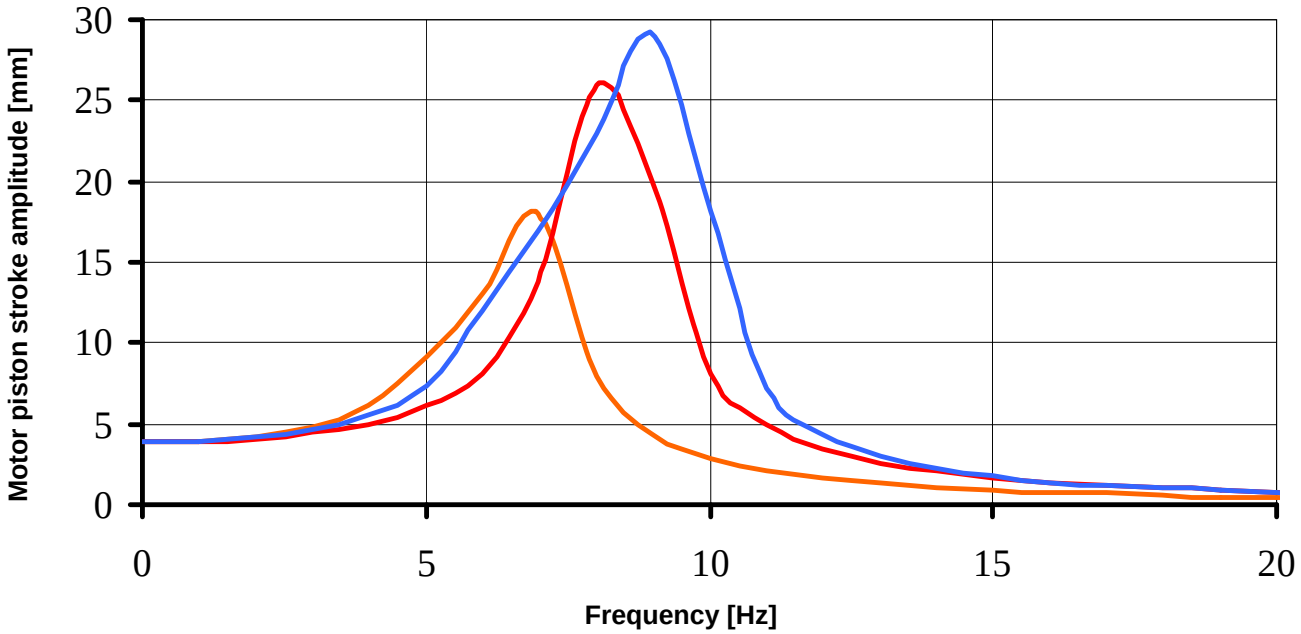

Fig. 3. Hydraulic motor piston strokes evolutions by varying piston mass.

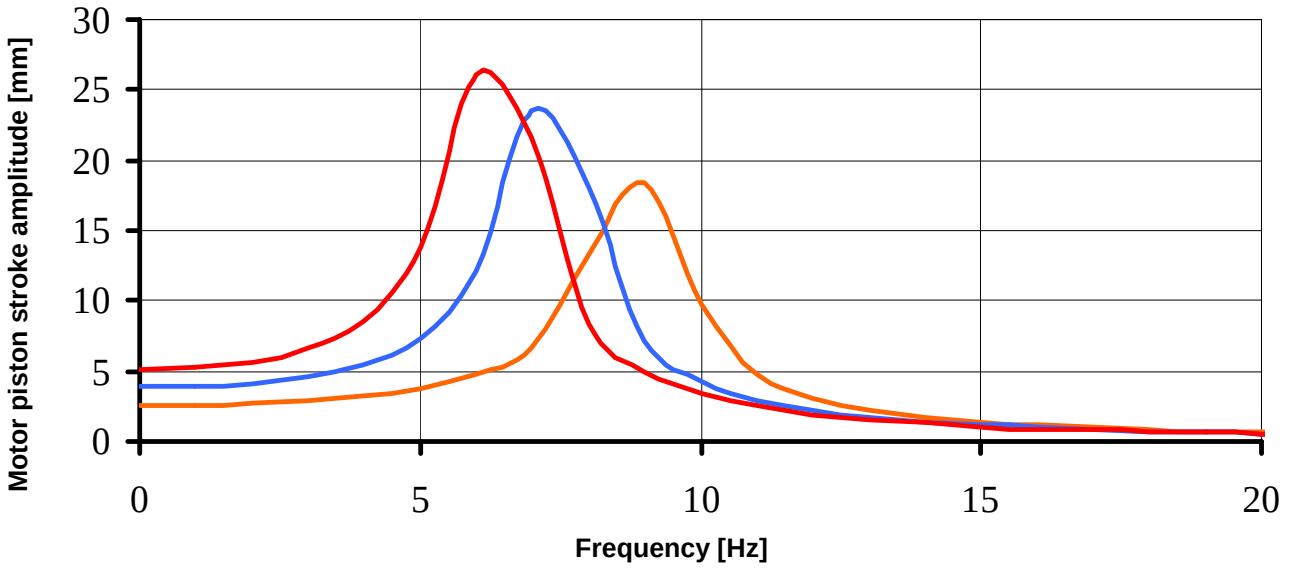

Fig. 4. Hydraulic motor piston strokes evolutions by varying oil column rigidity.

3. Conclusions

The objective of this research was a new approach of the hydraulic drives, in which the pressure and flow is not continuously transmitted between the energy converters (pumps and motors).

The experimental results, combined with the developed mathematical model of this system, demonstrates the possibility to adjust, during the functioning, several input parameters (like the initial static pressure and the generator angular speed), in order to obtain the anticipated output values of some parameters, or if the system load is modifying.

Also, the experimental measurements were looking especially for a dynamic behavior study of the entire hydraulic system, for both the motor working volumes interconnecting schemes, star and delta, with and without load, the mechanical and hydraulic parameters evolution studied individually and comparatively.

Considering the entire hydraulic system an experimental-demonstrative model working with alternating flows and harmonic pressures, we can conclude that all the advantages of the closed hydraulic circuits are preserved.

The analytical model is a simplified one, in which is considered only the friction forces.

The limitations of this type of hydraulic system are determined by the use of rigid pipes for components connection, the necessity of preserving a constant average pressure in each phase pipe and the relatively short life span of the hydraulic oil, which cannot be filtered during the functioning of the system.

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NUMERICAL ANALYSIS OF A CONTROL STRUCTURE FOR VARIABLE PUMPS

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Abstract: *Due to the advantages of hydraulic systems with variable displacement was necessary to design a control system, that contain sensors required for different structures of adjustment and that can be easily integrated into the pump construction without change of its mechanical structure. The mathematical model of the control system studied in this paper is based on differential equations that take into account nonlinear influences such as pressure and flow rate dependence of leakage, saturation flow, pressure limiting, etc.., so the deviations from the real behavior be as small.*

Keywords*: electro-hydraulic system, numeric simulation, mathematical model.*

1. Introduction

Essential trends, manifested today in construction of hydraulic machines are those of flexibility and automation, meaning to increase their level of intelligence and adaptation to possible disturbances.

Introducing the concept of flexible system that involved the creation of auto-tuning systems capable to adapt to changes in manufacturing technology, through minimum intervention, and also adaptation in relation of any disturbing factor, gathered in a fully automated assembly in which human intervention is minimized or not required. The elimination in general almost complete of the human operator has led to increased productivity by drastically reducing the time needed for big decisions, the handling of semi-manufactured products, by intervening in the case of tool wear, the diagnosis and the service.

A synthesis of experimental studies and researches conducted in recent years, on adjustable pumps and motors is presented in the paper [1]. Are presented in a coherent manner both experimental studies and numerical analysis for a wide range of control structures. This paper is actually a synthesis of studies over two decades of a team of researchers at the Institute Hydraulic and Control Aachen, Germany.

Variable displacement pumps allow a control of energy, virtually with no loss in the main hydraulic circuit. Their use in hydraulic systems under perturbations, implies the existence of a regulator, to ensure a parameter of hydraulic power or even the power at a required level.

Currently this types of variable displacement hydraulic machines are manufactured:

- with vanes
- with axial pistons
- with radial pistons

The command of the displacement can be done in two ways:

- proportional to a mechanical parameter (pressure, force, movement);
- proportional to an electrical parameter (voltage, current intensity).

As above, automatic control systems of pumps are classified in:

- mechano-hydraulic;
- electro-hydraulic.

Although starting from the '80, companies with a tradition in manufacturing pumps and motors with axial piston and variable displacement, produce this machineries for high automation hydraulic systems (Rexroth, Bosch, Vickers, Parker.) the existing data in the literature on constructive solutions are few.

2. Electro-hydraulic system description and mathematical model

Below is presented a schematic diagram for automatic control system proposed for implementation in a research program, in two versions. The difference between the two diagrams lies in the linear hydraulic motor control. In the first case the motor is commanded with two variable hydraulic resistors for motor control, and in the second case we have four variable hydraulic resistor that control the hydraulic linear motor.

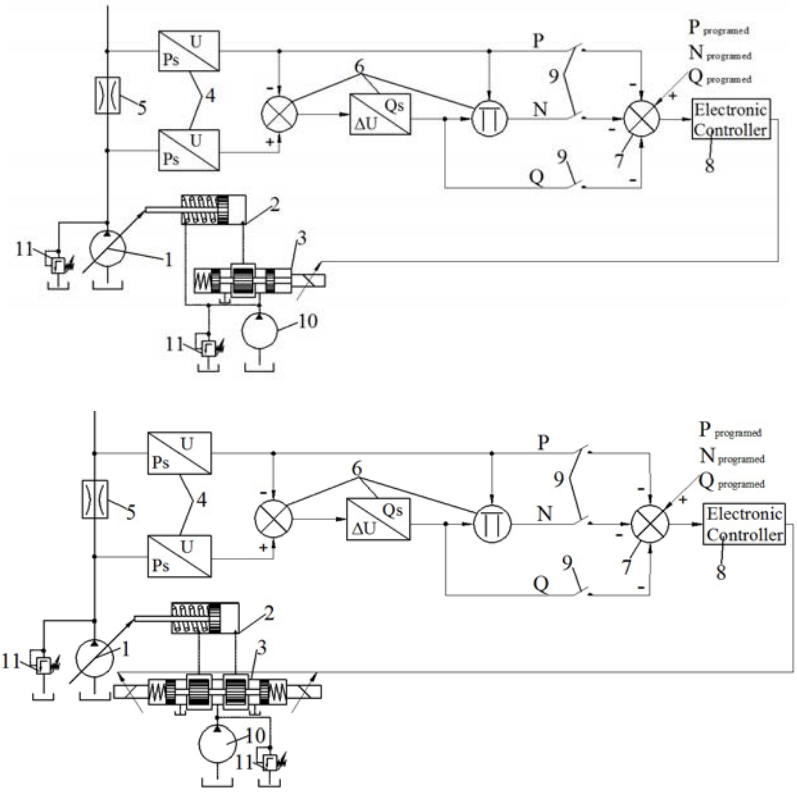

Fig.1. Electro-hydraulic control system for variable displacement hydraulic machines

The system contains the following components:1 - variable displacement pump with axial pistons; 2 - linear hydraulic motor need to change the angular position of the piston block holder so modify the flow of the pump; 3 – proportional directional valve, that control the position of the linear motor, 4 - pressure sensors; 5 – diaphragm, needed to measure the flow rate of the pump; 6 – electronic circuits with the following attributes: calculate the pressure drop on the diaphragm, then determine the flow, and then with the signal from a pressure sensor and the signal that represents the flow is obtained the hydraulic power consumption; 7 - electronic comparator, designed to find the error between programmed and actual value of the adjusted parameter (pressure, flow, power); 8 – electronic controller, used to compensate the error and gives the command signal for proportional valve; 9 - switches whose state determines the control structure; 10 – fixed displacement pump, provides the necessary flow for positioning hydraulic motor; this flow can be taken from the adjustable

pump's flow, in this case the auxiliary pump is no longer required; 11 – relief valve, protects the system to not exceed the permissible pressure in hydraulic components.

The equations system of the model in which the motor is controlled by a bridge with hydraulic resistors of type A+E is:

$$\begin{cases} \dot{p}_A = \dfrac{E_u}{V_A + A\cdot x_m}(k_v \cdot x_{v1} \cdot \sqrt{p_a - p_c} - A\cdot \dot{x}_m - k_v \cdot x_{v2} \cdot \sqrt{p_a}) \\ \dot{p}_B = \dfrac{E_u}{V_B + \alpha\cdot A\cdot x_m}(Q_c - \alpha\cdot A\cdot \dot{x}_m - k_v \cdot x_{v1} \cdot \sqrt{p_a - p_c}) \\ m_v \cdot \ddot{x}_v = -k_{ae}\cdot x - F_{ae} - F_{fv} - F_{R_i} - F_{R_e} + F_{em} \\ m_p \cdot \ddot{x}_m = A\cdot p_A - \alpha\cdot A\cdot p_B + F_{am} + k_m \cdot x_m - (c_3 + c_4)\dot{x}_m + \dfrac{m\cdot\omega^2\cdot R^2}{a^2}\cdot x_m - \dfrac{\pi\cdot d^2\cdot R}{4a}\cdot \\ U = K_p\cdot(U_{ref} - U_r) + T_d\cdot(\dot{U}_{ref} - \dot{U}_r) + \dfrac{1}{T_i}\int (U_{ref} - U_r)\cdot dt \end{cases} \quad (1)$$

The equations system of the model in which the motor is controlled by a bridge with hydraulic resistors of type A+A is:

$$\begin{cases} \dot{p}_A = \dfrac{E_U}{V_A + V_T}\cdot\left[Q_A - A\cdot\dot{x}_m - c_{LG}\cdot\dot{x}_m + c_{LP}\cdot(p_A - p_B)\right] \\ \dot{p}_B = \dfrac{E_U}{V_B + V_T}\cdot\left[-Q_B + \alpha\cdot A\cdot\dot{x}_m - c_{LG}\cdot\dot{x}_m + c_{LP}\cdot(p_A - p_B)\right] \\ Q_A = \begin{cases} \alpha_Q\cdot d_V\cdot\pi\cdot x_V\cdot\sqrt{\dfrac{2}{\rho}\cdot(p_c - p_A)}, & x_V \geq 0 \\ \alpha_Q\cdot d_V\cdot\pi\cdot x_V\cdot\sqrt{\dfrac{2}{\rho}\cdot(p_A - p_T)}, & x_V < 0 \end{cases} \\ Q_B = \begin{cases} \alpha_Q\cdot d_V\cdot\pi\cdot x_V\cdot\sqrt{\dfrac{2}{\rho}\cdot(p_B - p_T)}, & x_V \geq 0 \\ \alpha_Q\cdot d_V\cdot\pi\cdot x_V\cdot\sqrt{\dfrac{2}{\rho}\cdot(p_c - p_B)}, & x_V < 0 \end{cases} \\ T_v\cdot\dot{x}_v + x_v = K_v\cdot U \\ U = K_p\cdot(U_{ref} - U_r) + T_d\cdot(\dot{U}_{ref} - \dot{U}_r) + \dfrac{1}{T_i}\int (U_{ref} - U_r)\cdot dt \\ m_p\cdot\ddot{x}_m = A\cdot p_A - \alpha\cdot A\cdot p_B + F_{am} + k_m\cdot x_m - (c_3 + c_4)\dot{x}_m + \dfrac{m\cdot\omega^2\cdot R^2}{a^2}\cdot x_m - \dfrac{\pi\cdot d^2\cdot R}{4a}\cdot \end{cases} \quad (2)$$

Thus without change in pump construction, this can be integrated into any control circuit for adjustable hydraulic machines, by simply actuation of an electrical switch.

In the following are presented the programs carried out using software package MATLAB (Simulink) for numerical simulation of two models.

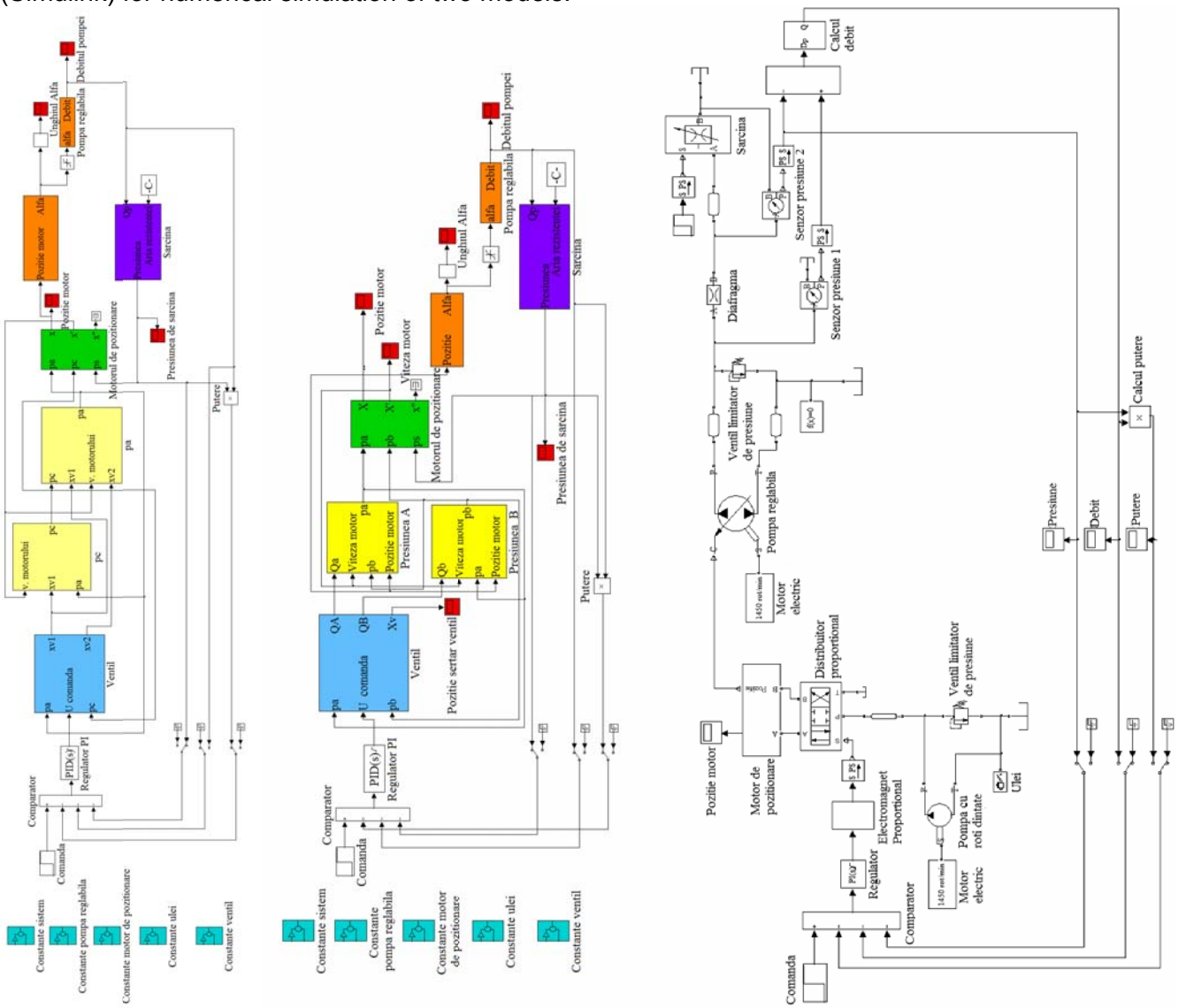

Fig.2. Simulink program

3. Simulations results

The objective of this work was to study the dynamic behavior of an electro-hydraulic control system for adjustable hydraulic pumps. This involved the use of concrete values for the physical and geometrical sizes involved in the model. Thus was chosen a F3 type, axial piston pump with variable displacement, made in Romania.

The PID controller was tuned using Ziegler-Nichols method.

First its analyzed the behavior of the system like response to step command for pressure, flow and power.

When adjusting the pressure the control step represents the input signal corresponds to a variation in load pressure of 0 to 200 bar. When setting the flow the control step representing the input

signal corresponds to a variation in flow of 0 to 30 l / min. In the version of control the power the step control that represents the input signal corresponds to a change in power in 0-5 kW.

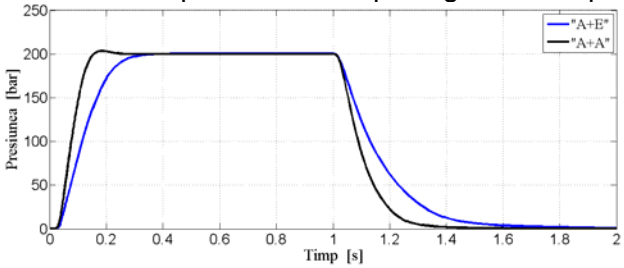

Fig.3. System response to step command from 0 to 200 bar

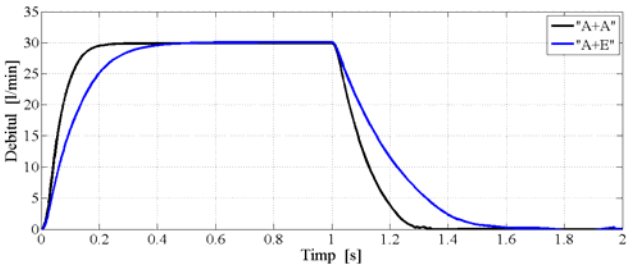

Fig. 4 System response (0 to 30 l/min)

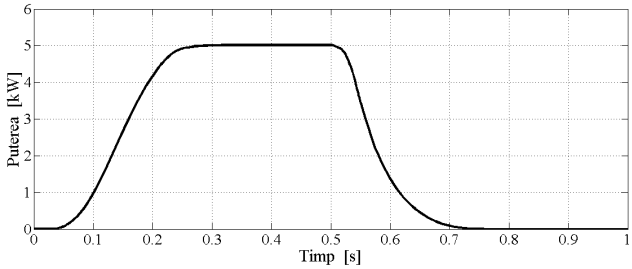

Fig. 5 System response (0 to 5 kW)

Then was studied the influence of hydraulic capacity, the areas ratio of the positioning motor and the load on the dynamic behavior.

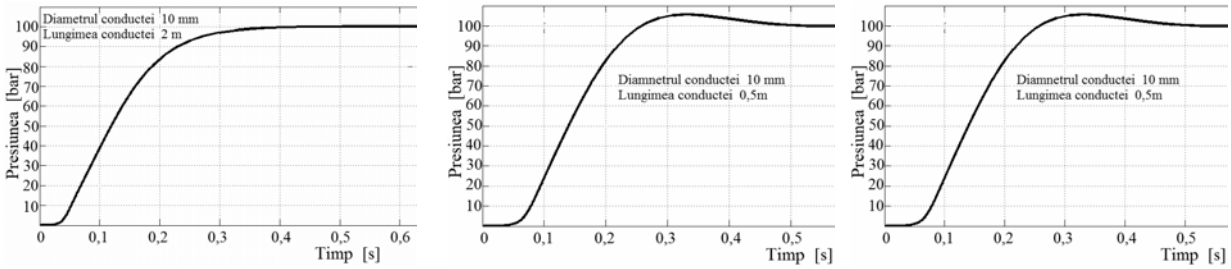

Fig. 6 Hydraulic capacity influence

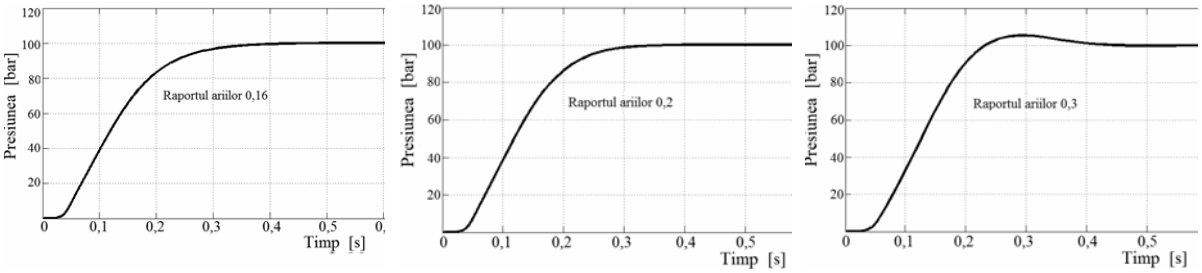

Fig. 7 Influence of the surfaces ration of the positioning motor

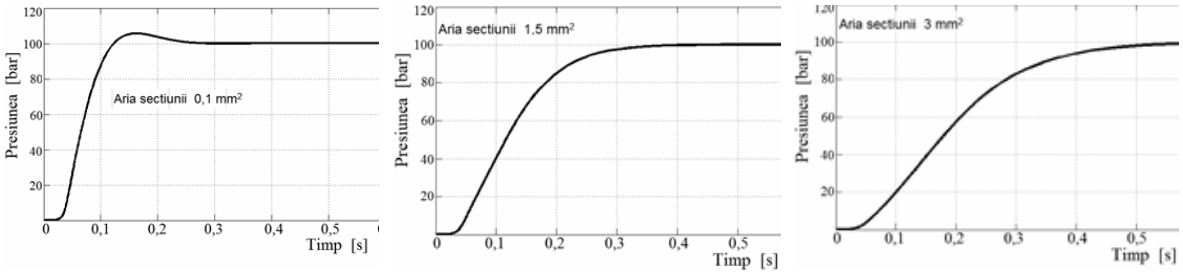

Fig. 8 Influence of the load variations

4. Conclusions

The static and dynamic performances of the system investigated:

- ✓ Stability - well-damped.
- ✓ Rapidity - response time less than 0.5 s.
- ✓ Precision - stationary error under 2.5%.

show that it can be used to adjust the variable diplacement pumps considering the performances required by industrial applications

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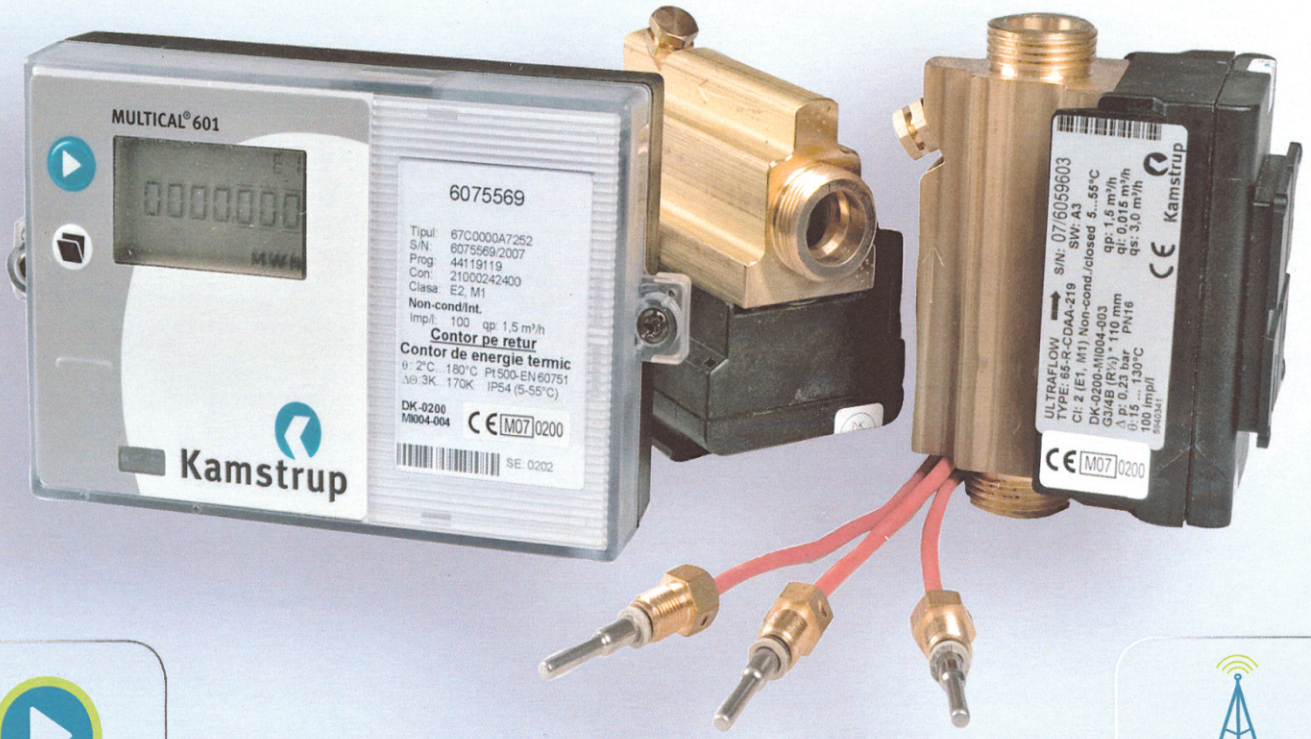

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APPROACHES IN HYDRAULIC - ROTARY HYDRAULIC MOTOR DRIVEN WITH ALTERNATING FLOWS AND HARMONIC PRESSURES

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Abstract: *The paper presents a new concept of rotary hydraulic motor, which can work using alternating flows and harmonic pressures. The classical solutions of hydraulic motors imply a unidirectional flow of the fluid through pipes between the energy converters, thus between the pump and the motor. The hydraulic transmissions using alternating flows are based on the bidirectional displacement of a finite (predefined) volume of fluid through the connection pipes between the alternating flow and pressure energy generator and the motor. The rotation motion of the main shaft is obtained using a conversion of the translation motion of the pistons of a number of hydraulic cylinders of small dimensions, the rotary movement being transmitted to the shaft using a series of drawn cup roller clutches. Each cylinder is connected independently, by a pipe (phase), to the output (outlet) of an alternating flow axial piston hydraulic generator. The rotation direction can be reversed by rotating with 180° the drawn cup roller clutches and by inversing the connections of the hydraulic motor.*

Keywords*: rotary hydraulic motor, alternating flow, harmonic pressure*

1. General aspects regarding alternating flows and harmonic pressures

The methods of energy propagation through liquids such as oil, is based especially on the continuous transmission of pressure and flow. The energy produced at the generator (pump) is transmitted to the end of the line to the motor, the fluid being considered uncompressible. In conventional hydraulic transmissions, the fluid performs a unidirectional motion between the energy converters in the power transmitting process. In harmonic flow hydraulic transmissions, the fluid executes an alternative periodical motion between the energy converters. In principle a very simple version of an alternate hydraulic transmission consist in two interconnected hydraulic cylinders, presented in figure 1. [3], [4]

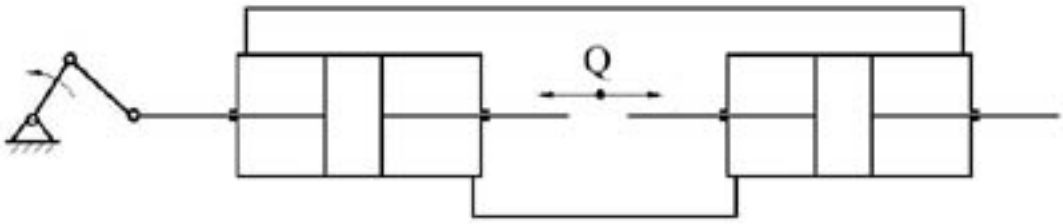

Figure 1. Working principle of the alternative flow hydraulic transmissions.

The periodical movement is transmitted to the piston of the first cylinder by a crankshaft mechanism, the piston executing a bidirectional movement, which provides an alternative flow *Q*, and consequently a bidirectional flow between the two cylinders chamber. Consequently the second cylinder will move synchronous with the first.

By analogy with the electric acting, the pump will be named generator, which provide harmonic flows and pressures.

We assume that the governing equations for the instantaneous flow and pressure are: [4], [5]

$$Q_i = Q_{a\max} \cdot \sin(\omega t + \varphi_0) \tag{1}$$

In which:

$$Q_{a\max} = \frac{\omega \cdot h_g \cdot S_g}{2} \tag{2}$$

And for the pressure:

$$p_i = p_{st} + p_{a\max} \cdot \sin(\omega t + \varphi_0) \tag{3}$$

As the figure 1 present, an alternative hydraulic transmission is a closed circuit and it not requires a tank for the working fluid. In other words we have hydraulic oil only in the pipes whose connect the energy converters (generator and motor).

For every forward movement of the generator piston an alternative flow will be generated, as well a high pressure zone will be formed. The final effect is a longitudinal oscillation of the fluid mass, which moves along the fluid line, starting from the generator piston side to the motor piston. If in the system pipes the initial pressure is zero, then the movement of the generator piston will provide only positive pressure peaks. By taking account the compressibility of hydraulic oil, it is possible that the motor piston to not move synchronous with the generator piston or worst to not move at all, depending on the lines (pipes) length. To avoid this situation the system will be external pressurized to an initial static value p_{st} , (see Eq. 3).

2. Constructive principles of the alternative hydraulic systems

Depending on the number of working elements we could obtain mono-phase or poly-phase alternative hydraulic systems. Each working element, in this case a cylinder-piston group, of the generator must be connected using a rigid pipe with a similar assembly of the motor.

Our research was made on the three-phase systems. As generator was used a modified axial piston pump (wobble-plate type) with three active pistons placed at 120° angles, which allows the variation of the plate angle, obtaining in this way different strokes for the pistons.

The hydraulic rotary motor working with alternating flows can be realized using the principles presented in figure 2 or figure 3. [1], [2]

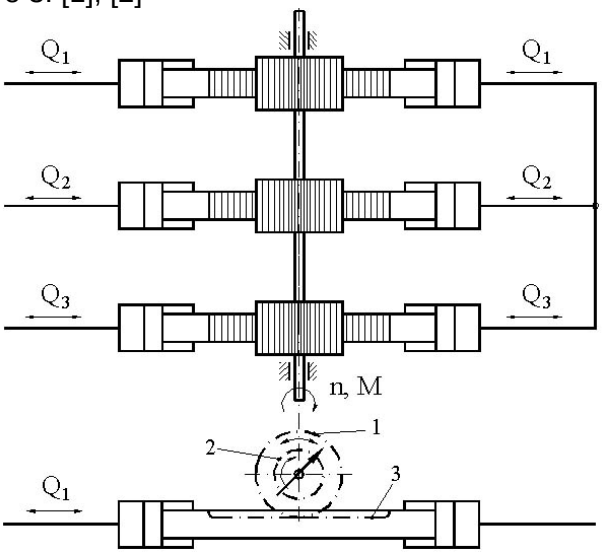

Figure 2. Functioning principle of hydraulic motor, with a star interconnection.

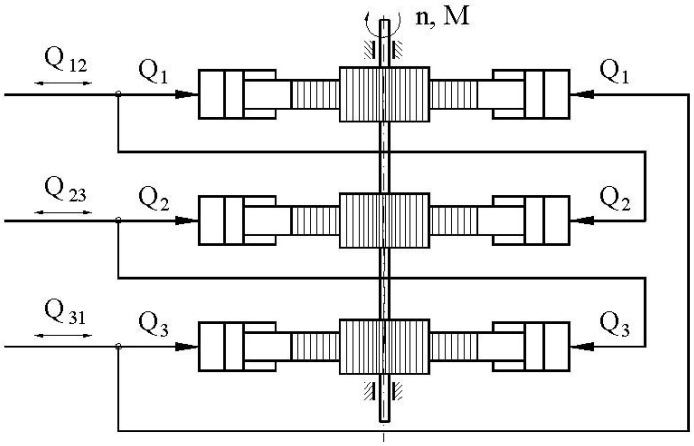

Figure 3. Functioning principle of hydraulic motor, with a delta interconnection.

The simplest solution for the construction of a rotary hydraulic motor working with alternating flow is to use in the same assembly three different oscillating motor with gear rack (see the elements 1 and 3 in figure 1). Because each piston moves independently, corresponding to his phase pipe it is compulsory to have the possibility that each gear wheel to act individually on the output shaft. This problem can be solved using an intermediary element, which provides a unidirectional rotation movement (see the element 2 in figure 2).

Other problem to solve is providing the retraction stroke of the motor pistons (idle stroke), because the three-phase generator, in this construction provides the alternative flow only for their active stroke. The simplest solution is to use a mechanical forced retraction with a spring, or like figures 2 and 3 present, to use the alternating flow provided by the generator, taking account that each piston of the generator have in the movement an alteration of phase with an angle equal to 120°. If we consider that solution we can obtain two separate interconnection possibilities for the working volumes of the motor, star or delta, named by analogy with the alternative current three-phase electric motors.

3. Aspects regarding the physical construction of the hydraulic three-phase alternative motor

According with the functioning principles enounced in section 2 was realized a prototype of a rotary hydraulic three-phase motor working with alternating flows. Because it is an experimental model it is designed in that manner to offer as many data is possible on the testing stand, like pistons strokes, pressures, and rotational speeds. Do to that fact the construction in not a compact one. [2]

Details regarding the construction of a working subassembly (hydraulic cylinder 16, pulley 14, and drawn cup roller clutch 13) of the three-phase rotary hydraulic motor working with alternating flows are presented in figure 4.

Each piston rod will act a pulley, using a steel cable or an elastic steel sheet, in which is mounted a drawn cup roller clutch. The stroke of the motor pistons can be mechanically restricted using the catch element 4. The spring 9 is mounted because the pulley must return every time in its initial position.

The three drawn cup roller clutches 13, mounted in the pulleys, offer the possibility that each hydraulic cylinder to act independently on the output shaft, corresponding to evolution of the alternative flow in the phase pipe, and obtaining in this manner a continuous rotational movement.

The motor incorporates three subassemblies, like those presented in position 16, each containing small double end cylinders.

Because the entire system is working with a small quantity of hydraulic oil it is highly desirable to have cylinders and lines perfectly sealed, to maintain an optimal working pressure.

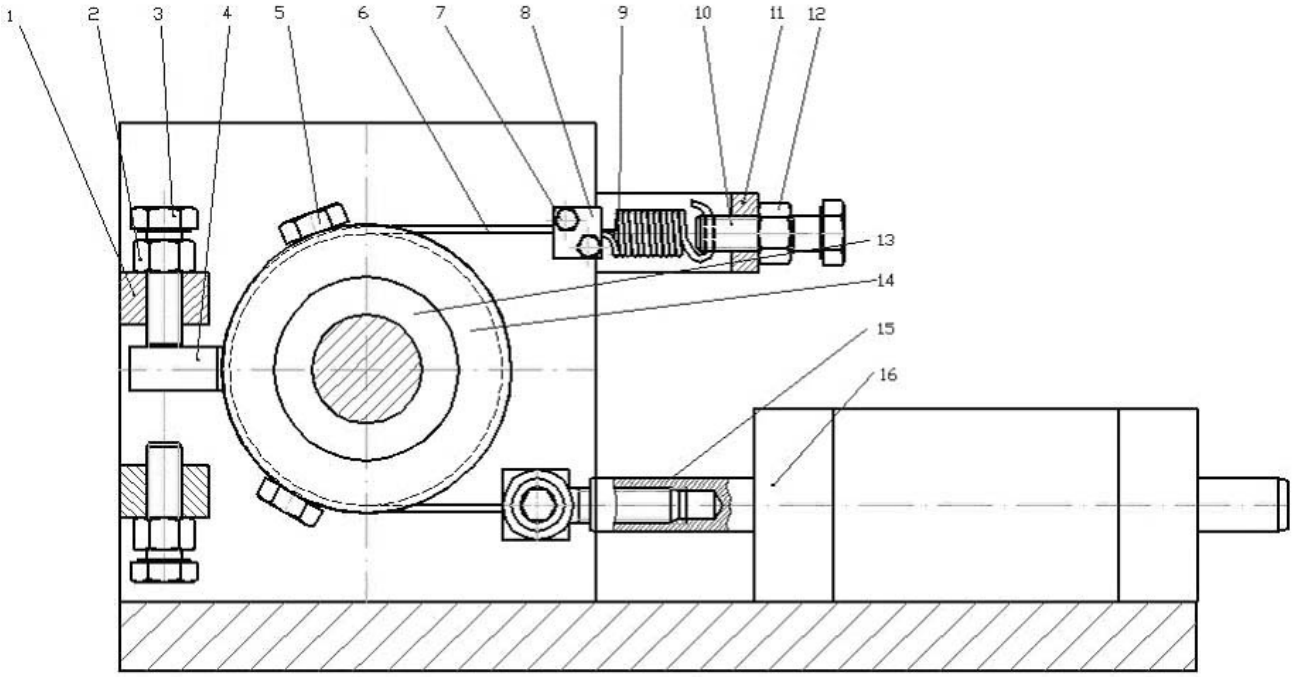

Figure 4. Three-phase rotary hydraulic motor working with alternating flows - view 1.

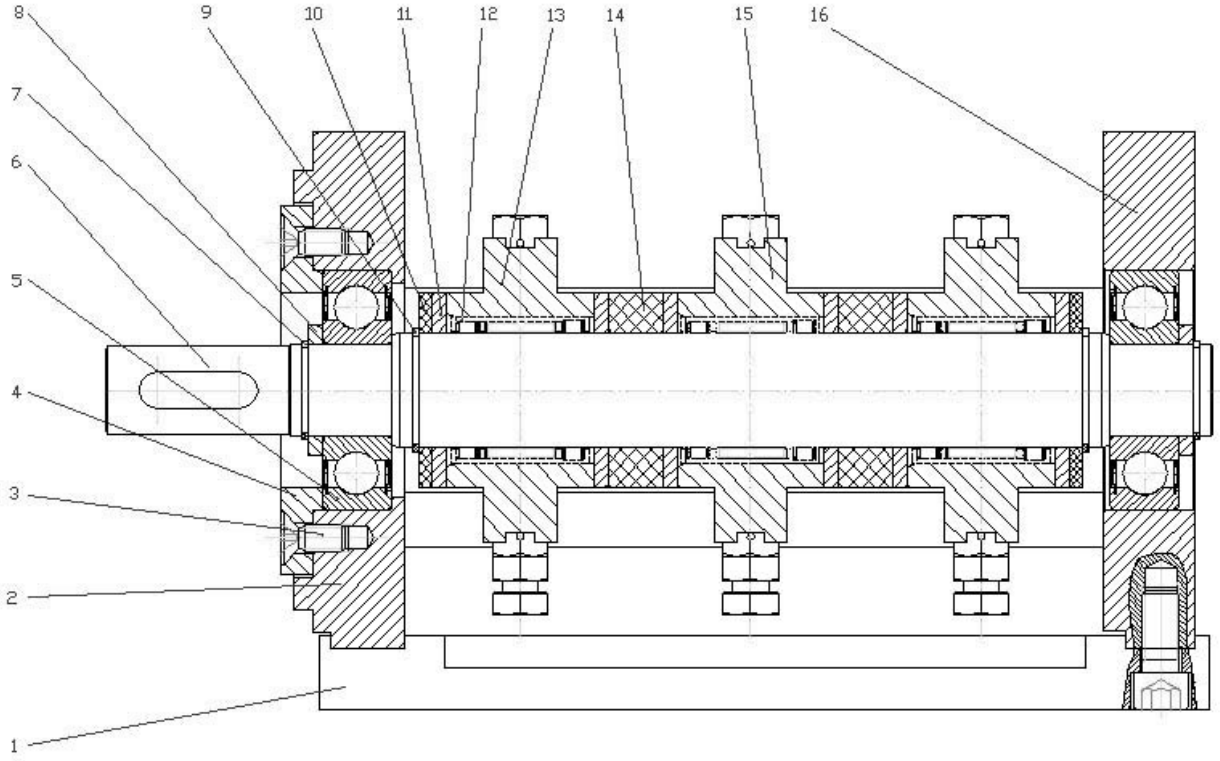

Figure 5. Three-phase rotary hydraulic motor working with alternating flows - view 2.

Another section of the motor assembly is presented in figure 5, making visible the three drawn cup roller clutches, position 12, acting independently on the motor output shaft.

The realized prototype of hydraulic motor will provide a rotational motion of the output shaft only in one direction. The rotation direction can be reversed if the drawn cup roller clutches will be mounted rotated with 180° and also by inversing the connections of the hydraulic motor.

The rotary motor it functioning in both, star or delta, interconnection configurations of the working volumes (cylinder chambers). Switching between the two connections is possible by changing the position of the external connectors of the phase pipes or by using a special designed rotary spool directional control valve.

The simplest solution for the construction of a rotary hydraulic motor working with alternating flow is to use in the same assembly three different oscillating motors with gear rack (see the elements 1 and 3 in figures 2).

Because each piston moves independently, corresponding to his phase pipe, it is compulsory to have the possibility that each gear wheel to act individually on the output shaft. The right solution for that is to use of an intermediary element, like drawn cup roller clutch, which provides a unidirectional rotation movement (see the element 2 in figures 2).

Because the three-phase generator, in this construction, provides the alternating flow only for its active stroke, the retraction stroke of the motor pistons (idle stroke), must be made by using the alternating flow provided by the generator, taking account that each piston of the generator have in the movement an alteration of phase with an angle equal to 120°. If we consider that solution, we can obtain two separate interconnection possibilities for the working volumes of the motor, star or delta.

According with the enounced functioning principles in was realized a prototype of a rotary hydraulic three-phase motor working with alternating flows, in a compact design, figure 6. [2]

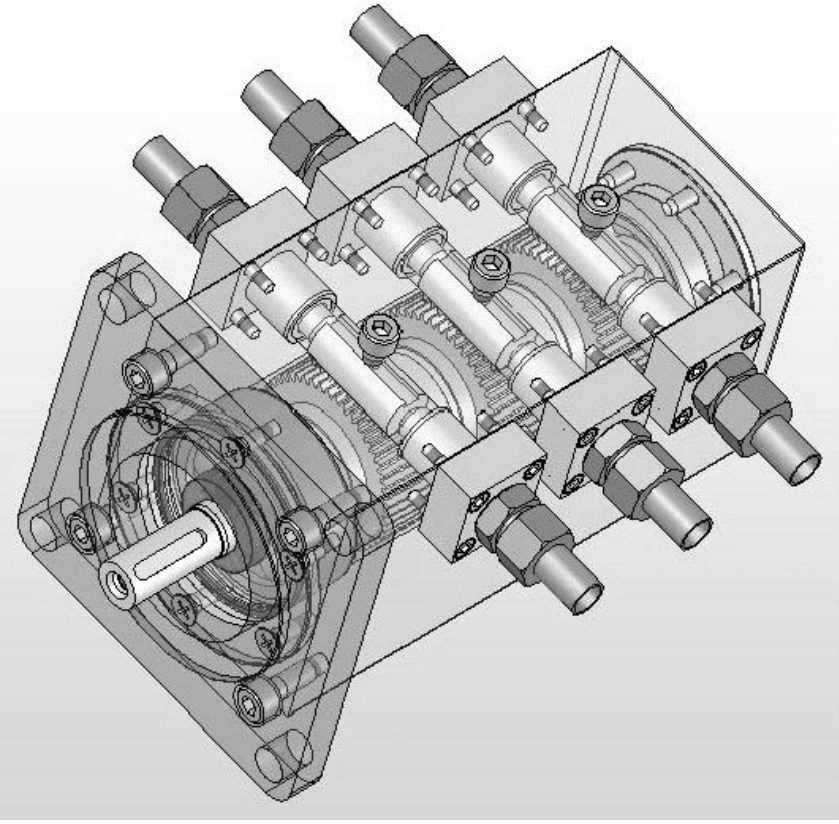

Figure 6. The design of the alternating flow driven three-phase rotary hydraulic motor.

Figure 7 present in detail the gear rack conversion mechanism, of the piston strokes, which collect the movements from the oscillatory oil column. [2]

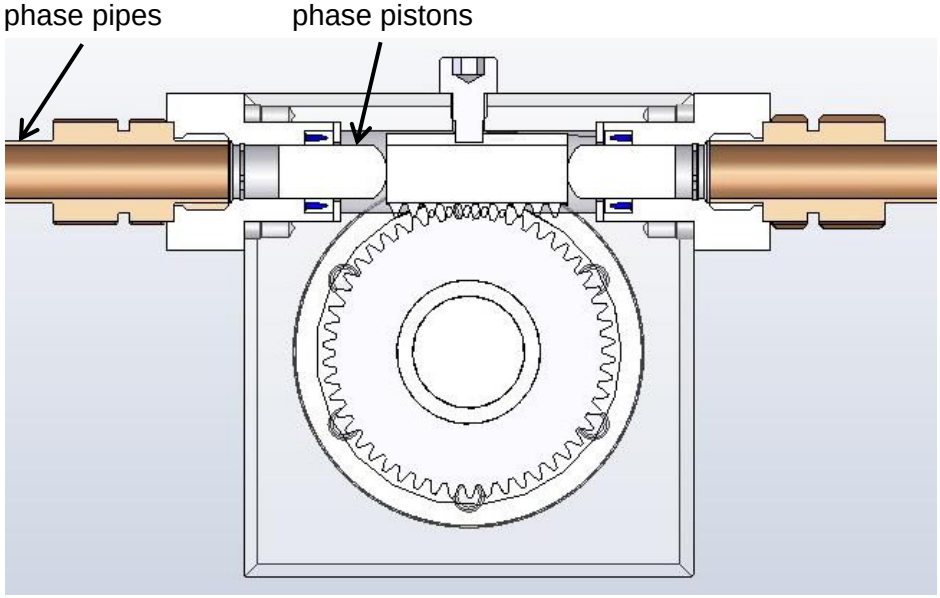

Figure 7. Hydraulic motor gear rack conversion mechanism - detail.

4. Conclusions

The work paper proposes a different view of under-pressure hydraulic drives, in which is presented an energy transmission without oil transport between generator and motor. This is realized mainly by introducing of a fluid column oscillating state, in such a way that the hydraulic energy produced at one end of the pipe to be transmitted step by step to the other end, where, it can be converted into mechanical work.

The paper also presents a prototype of rotary hydraulic motor, which can work using alternating flows provided by a special designed generator. In the construction of the motor are used three small hydraulic cylinders, their pistons being moved by the oscillation of the liquid mass closed in the corresponding phase pipes. The oscillatory displacement of each piston is transmitted independently to the same output shaft using a high performance drawn cup roller clutch.

The rotary hydraulic motor can function by using two types of interconnection configurations between the cylinder chambers, star or delta.

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COMPORTAREA TRIBOLOGICA A SISTEMELOR DE ETANSARE

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Rezumat: *Studierea fortelor de frecare dintre etansare si metal constituie o problema dificila de rezolvat . Lucrarea incearca sa rezolve problemele care le ridica cercetarea, respectiv dispozitivul de masurat fortele de frecare.*
Cuvinte cheie*: etansare, cauciuc,forte frecare,*

Comportarea aleatoare a unor etansari la **presiuni mici** prin deplasari sacadate , presiuni mari de pornire a cilindrului fac ca sistemele de etansare clasice sa nu poata fi folosite in siguranta.

Din practica curenta se stie ca presiunea de pornire a cilindrilor hidraulici este de circa 0-6 bar. Forta hidraulica care se aplica pistonului la aceeasi presiune de pornire pentru doua pistoane de cilindriu cu diametre diferite variaza cu patratul diametrului ($F_1/F_2 = D_1^2/D_2^2$) unde F este forta de frecare si D este diametru cilindrului . Daca consideram ca de obicei prin proiectare, profilul etansarii se pastreaza la diametre diferite, atunci ar insemna ca *forta de frecare pe unitatea de lungime* a etasarii ar trebui sa fie la fel pentru cilindrii de diametre diferite si atunci forta generata la presiunea de pornire ar trebui sa respecte raportul $F_1/ F_2 = D_1/D_2$.

În literatura de specialitate se specifică, că elastomerii nu se supun legilor clasice ale frecării de alunecare pentru corpuri rigide. Coeficientul de frecare al garniturii se modifică pe măsura utilizării, a încălzirii, a variației presiunii de utilizare

Corpurile rigide resimt frecarea prin microsudură (încălzirea şi topirea punctelor de frecare) şi prin roaderea suprafețelor de contact.

Elastomerii resimt frecarea prin:

-legături chimice între lanțuri polimerice şi suprafața metalică (necesitând fracționarea legăturilor pentru a permite mişcarea);

-deformarea elastomerilor (care absorb mai multă energie în timpul deformărilor decât dau înapoi sub formă de energie mecanică, atunci când sarcina de deformare este eliminată);

-o cantitate de uzură (îndepărtare de material)

În jocurile înguste apare, la curse lungi, în cilindrii hidraulici, o curgere "prin tragere" ("Schleppströmung"). Dacă lichidul astfel tras este droselizat în continuare într-un alt joc îngust, de exemplu interstițiul unui al doilea element de etanşare sau al raclorului, se crează o presiune în camera dintre cele două elemente de etanşare. Această presiune poate depăşi presiunea de lucru din sistem, şi astfel elementul de etanşare se poate răsturna/răsfrânge sau poate fi presată afară/extruda din poziția sa. Astfel, elementele de etanşare se pot aşeza oblic, ceea ce duce la uzarea prematură a lor, iar racloarele pot fi chiar aruncate afară din locaş.

Formula presiunii p_s create prin efect de tragere in functie de presiunea p_N conform literatura de specialitate este:

$$p_s = p_N + \frac{v \cdot L_S \cdot 6\eta}{s^2}$$

din care reiese, că viteza *v*, lungimea jocului, L_S, viscozitatea η, şi mai ales un joc s mic conduc la creşterea presiunii prin tragere.

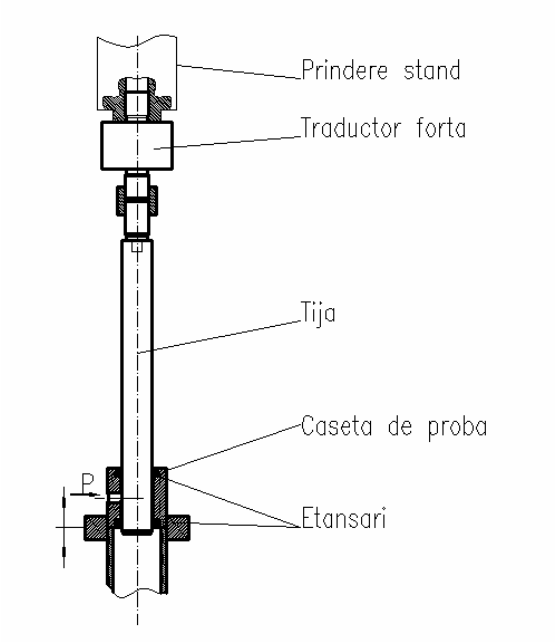
Apariția acestei presiuni nedorite poate fi preîntâmpinată prin măsuri constructive şi prin alegerea elementelor de etanşare corespunzătoare, de ex. de tipul Turcon Stepseal K, cu efect hidrodinamic, "de pompaj" (etanşări active).

Uzura prin adeziune. În stare statică apar aşa-numitele forțe Van der Waals între elementul de etanşare şi suprafața conjugată (contrapiesă). În special la etanşările din elastomer această presiune de contact este foarte ridicată. Forța de desprindere la începutul mişcării poate fi atât de mare, încât părți din material sunt desprinse de pe suprafață.

Din cele de mai sus rezulta conceptul lucrarii de cercetare , care apare ca urmare a observarii fenomenului de aderenta intre etansari si suprafata metalica unde se realizeaza legaturi chimice care pot apare ca urmare a contactului direct intre ele. De aceea cercetarea merge pe doua cai prin emiterea a doua ipoteze de lucru : una de utilizare de nanoparticole, grafit , teflon, etc.. care sa separe suprafetele, si a doua cale de utilizare a tehnicii active de vibrare a etansari care nu permite timpul necesar ca sa se realize legaturi chimice intre cele doua suprafete de contact. Ipotezele de lucru vor fi confirmate sau infirmate prin elaborare de modele conceptuale si experimentarea lor.

Pendru a dezvola o cercetare in domeniu comportarii tribologice a etansarilor trebuie gasit o modalitate de masurare a fortelor de frecare. De obicei verificarea etansarilor se efectua pe aparatul(cilindrul) in care se monta si se supunea la probe o data cu acesta .

In cadrul unui cilindru este greu a se separa fortele de frecare de fortele inertiale, fortele hidraulice sau fortele gravimetrice. Pentru rezolvarea problemei s-a proiectat o caseta de proba vezi desenul alaturat in care se elimine fortele hidraulice prin constructia simetrica a casetei , fortele inertiale prin legarea traductorului la partea imobila a dispozitivului ,fortelor gravitationale active prin montarea verticala a dispozitivului. Singurul incoviniemt al montajului este ca forta de frecare se determina pentru doua etansari o data .



In figura este reprezentat un dispozitiv de determinare forte de frecare in etansari tip tija. Caseta de proba este formata din o tija de cilindru si o carcasa in care se introduce cele doua etansari. Lichidul de lucru se introduce la presiunea de proba P intre cele doua etansari . Intre tija si

caseta este prevazut un joc astfel ca contactul dintre ele se face numai prin intermediu etansarilor. Tija se leaga de stand prin intermediu unui traductur de forta. Caseta de proba este legata la partea mobila a standului care prin deplasare genereaza forte de frecare la contactul dintre etansari si tija , forte ce se citesc la traductor

Concluzii

Prin realizarea dispozitivului in cadrul Laboratorului de etansari din IHP, introducerea acestuia intr-un stand de actionare prevazut cu un actuator si sistem automat de culegere a datelor s-a putut rezolva probleme de masurare a fortelor de frecare din diferite lucrari de cercetare , printe care amintim proiectarea de tiposerii de etansari sau confirmarea fortelor de frecare rezultate in urma modelarii matematice colaborare cu colegii nostril de la Universitatea Poitiers din Franta

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[2] SIMPOZIONUL HERVEX 2009 Tehnologie si ansambluri de etansare combinate din elastomeri si panza pentru presiuni inalte si medii agresive Dr ing Adrian Mirea , ing. ANGHEL Sava

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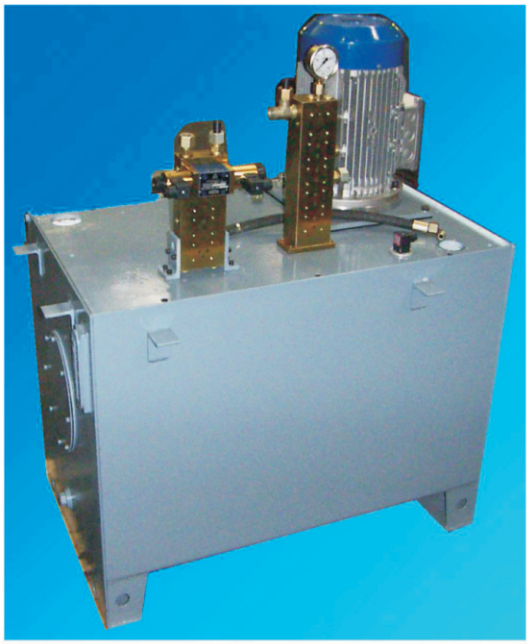

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HIGH BEARING MECHANICAL STRUCTURES MADE OF THIN WALL STEEL PROFILE USING INNOVATIVE SOLUTIONS IN THE FIELD OF HYDRAULICS AND RESISTANCE CALCULATION METHODOLOGY

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Abstract: *This article presents technical solutions to achieve the underlying strength of metal structures for construction (halls, houses) of thin-walled steel profiles with improved performance, as an alternative to current solutions used, in which by combining hydraulics and techniques calculation to obtain a device capable of operating in terms to meet these requirements. As a specialized institute in the field of hydraulics, INOE 2000-IHP Bucharest participate in the realization of the design solutions of multitasking equipment and part of the process that underlies the technology to achieve new types of structures with wall profiles thin.*
Keywords*: steel profile, multitasking equipment*

1. Introduction

The new thin-walled sections which are subject in achieving enhanced structures-bearing called composite profile realized by axial assembly of standard metallic profiles from thin metal sheet in accordance with mechanical resistance requirements in the field in which are used and checked and certified during the manufacture process of the complex section profile. In this purpose is made a new technology that combine the modern technical analyze software in manufacturing process of the thin complex section profiles with electronic display console on which is visualize the technological working parameters.

The products made on this equipment are used, in general, like resistance pillow or buoyant beams in civil engineering especially at halls with metal structures, home building and in others applications.

The equipment used to manufacture these products, that involves using data from a logistics center equipped with IT hardware and software design and verification constructive steel structures, these in formations are sent to the equipment (also to the similar equipments that used the same technology, if is necessary). The product manufacture and the technical working data display on a fixed to the equipment, from whom it possible to control all the manufacture process.

Market attractiveness of such equipment is based on the following:

1 - The proposed technology that will be used for equipment, guarantees a correct choice of metal structure by builders, giving them a complete analyze which for thin profile is different from the classical structures;

2 – the pillar and beam buoyant made form assembled profiles lids to cut down the montage cost on site, different from technological the classical solutions used before;

3 - the montage of new structures on site, not require changing existing technologies work;

2. State of art

2.1. Global and national situation in this field of l*aminate thin profiles*

Cold laminated worldwide market is constantly developing, regardless of category which we refer: cold rolled, cold bent or cold pressed.

resistance allied with a comparable price per meter. In this way it was removed the restriction to use thin profiles as bearing elements.

Thin profiles that we can find on the international market have many sections, but we can find only 10 of them in portable systems applications, including those with section composed not in Europe, but in America and Asia.

In the last decade, thin-walled profiles industry had the highest rate of growth due to the real-estate boom with 15% each year, in witch where used to create thermal isolation systems. This step was largely related to technological improvements made in this field of activity, of which the most in buoyant was the replacement of corrosion protection procedures with other forms of protection. Most effective replacement proved was thin galvanized sheet profiles, with sheet

Currently there is only one company in Romania that produce thin profiles structures, and this company is "GIROMETAL" from Galati. The few existing international brands in Romania, like LINDAB, that have the means to manufacture the buoying systems are not yet interested in any business to start with this field.

2.2. Global and national situation in this field of manufacture technologies and equipment performances

The most productive systems are using roll lamination in order to obtain simple profiles, this process is particularly recommended for large production series or when is done a profit over 3 m in length. In small series, most profitable are obtained in bending or molding processes.

In all of these cases are dozens of companies in Europe to produce equipments or devices for thin sections, but only a few multitasking equipments, like: SCHRODER-Germany, RICO -Portugal; JORNS AG - Switzerland.

In Romania from the processing equipment industry profiles are made by several companies, as for example "SC EUROTECHNICS SRL", but none of them make composed section profiles. From this point of view, SC FAST ECO offer to be the first to propose a device for composite profiles

2.3. Research activities in the field of thin profiles in Romania

In Romania the research in profiles with thin walls were made by several research centers, such as: Timisoara "Politehnica" University - who published several books in this area, "Tehnica" University from Cluj-Napoca - Department of Resistance that has made some experimental activities on this types of products; and also by Research Centers like: INCERC – Bucharest, and URBAN PROJECT, in bearing structures expertise activities and approval release.

3. Solutions description

3.1. Technical and/or Scientific Content

Scientific and technical aspect, the use of thin buoyant profiles made of cold-formed high-strength alloy steel involves **solving outstanding design issues that are not encountered in the design of structures made of ordinary steel profiles,** obtained by hot rolling or by welding plates.

The effect of cold forming by cold-straining, affects physicochemical properties of base material (steel plates) by raising the flow value and the resistance over the profile, resulting in reduction of material ductility.

Also cold forming by rolling, bending or pressing, induce a residual stresses by flexion, which higher at the corners, but with opposite sign comparing with yield factor.

Cross-sectional shapes for cold-formed profiles are of great variety and usually more complex than those of hot-rolled or welded.

The most used are the types are: U, L, Z, C, T, G, and ∑. As you can see, cold-formed sections are usually conjugate and even unsymmetrical, having additional thickening at the ends or on soles, and even intermediate thickening on the middle arias and wide soles.

Cross sections due walls slenderness are class 4 or, at most, downgrading to class 3.

Therefore, the calculation of structures made of these profiles will be always in the elastic domain when the sections view the walls are class 4but in the same time it is necessary to take in to consideration the buoyant phenomenon and to operate on reducing the geometric features, namely to the transversal effective section.

Forms of local instability and distortion can be considered as global instabilities that are submitted to simple or compound stress (bending, twisting or bending, twisting), giving rise to buckling phenomena that is influenced by geometric imperfections or by type loading, that is dramatically reducing the ability buoyant structural elements.

Therefore, the sizing of simple or complex structures made by thin profiles is necessary to make the stability test of sections made from these profiles.

To achieve thin-walled structures from steel profiles is generally used a specific assemblage technology, calculation and checking procedures are largely different from conventional metal joints used in construction.

Consequently, **the choice of profiles technology implementation, their dimensioning analyses and design are essential operation in order to obtain a safe and effective structure from technical and economical point of view.** Overall conception of the thin walled structures made of cold formed steel sections, the composition of structural elements with simple or complex section, the methodology and details of assemblage, their design procedure is different from conventional metal structures.

From these reasons, for this type of structures is essential to elaborate specific dimensioning and design normative. On national level this normative is STAS 10108/2-1983 – „Constructii civile, industriale si agricole. Calculul elementelor din profile cu pereți subțiri formate la rece", completed by NP012/1997 – „Normativ pentru calculul elementelor din profile de otel formate la rece" published in Buletinul Construcțiilor no.15/1998. NP012/1997 is the adapted Rumanian technical standards system of for construction steel Romanian, the European standard EUROCODE 3 – Part 1.3 (ENV 1993-1.3/1996). Al this normative are referring to thin profiles, in this project it is achieving an dimensioning algorithm that can establish a the geometric shape and dimensions, the maximal loads, the bending and twisting moment verified thro mathematical analyze and simulations, and experimental validation in laboratory. In the end will be integrated in a specific technologic system.

3.2. The originality of the project is based on the following:

a) Regarding the proposed technology.

Approach the issue of achieving high load buoyant structures (pillars and beams) of thin complex profiles in industrial field and not in the construction, like any metal construction it is required that the chef of the executing team to have a high AQ level, taking in to consideration the risks and the responsibilities, and also the European normative regarding the safety in civil engineering field. This project has an original view, by using in a unique way the virtual analysis techniques, dedicated software and special methodologies The control unit uses the analytic techniques for dimensioning the simple and complex profiles, developed form 1997. These algorithms will be implemented in a specific methodology together with dedicated software, in order to respect the European normative for thin profiles, which is referring to the exploitation safety of this product, EUROCODE 3 – Part 1.3 - ENV 1993-1.3/1996

b) Regarding proposed equipment

In this project we want to make **three versions for this equipment** that will be able to **manufacture, assembly and verify** the complex profile which will derive from the model proposed in this project, in this way will be possible to be configured this system in accordance with the beneficiary needs in order to manufacture an complex product with high performances;

It follows thus achieving a high precision control methods for those that manufacture this type of large buoyant structures, taking into account the European recommendations regarding construction safety;

Unlike traditional technologies that need more equipment in order to realize the complex profile, our equipment has a multitasking unit, with a unique power unit that is mentioned as Force group.

3.3. The innovative aspects

The innovative elements of this project will produce patents proposals that will be relate to:

Developing two new profiles with complex section, similar in concept to proposed **patent registered to OSIM no. A/01009 from 07.10.2011 by SC FASTECO SA**;

Using of the new hydraulic control units in order to adjust the working parameters of this equipment (forces, moments, working speeds). It has applied to the extrapolation of the proposed **invention registered to OSIM no. A/00183-23.02.2011 by IHP Bucharest**, regarding the selection procedure of operating modes at compression units using proportional hydraulic with digital interface;

Developing a new working technologies of this equipment that combine the profile dimensioning program with resistance testing method directly on the machine.

3.4. Representative types of the proposed composite profiles to achieve and equivalent their classical solutions.

In Figure 1 are presented as examples four profiles composite model sizes representative: the equivalent section I, square, rectangular and cylindrical whose main features are:

- Form factor (dimensional) Kab is reduced to 1.5 ... 2 times the F = ct.;
- Bearing coefficient (resistance) Kforta increases of 1.5 ... 2 times a, b = ct.

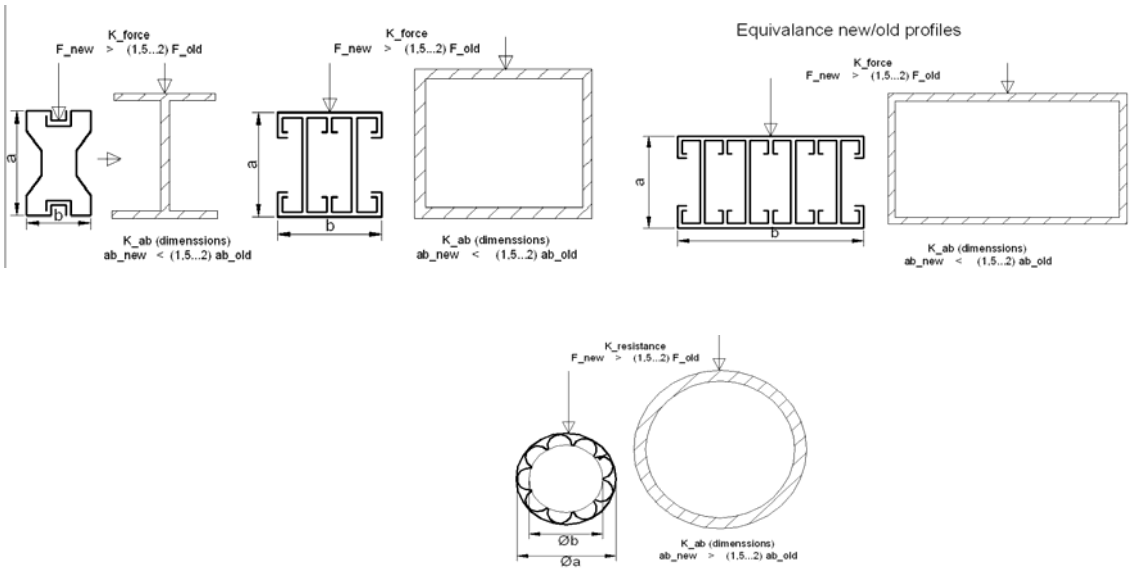

Figure 1

Technological achievement module of these profiles makes the subject of a patent application filed with OSIM of IHP Bucharest and SC FAST ECO SA Bucharest

The principle scheme that underlies the proposed technologies is shown in figure 2

New technology features consists of:

-compound profiling on a single equipment

-equipment ensure the profile test made at performance to required by application.

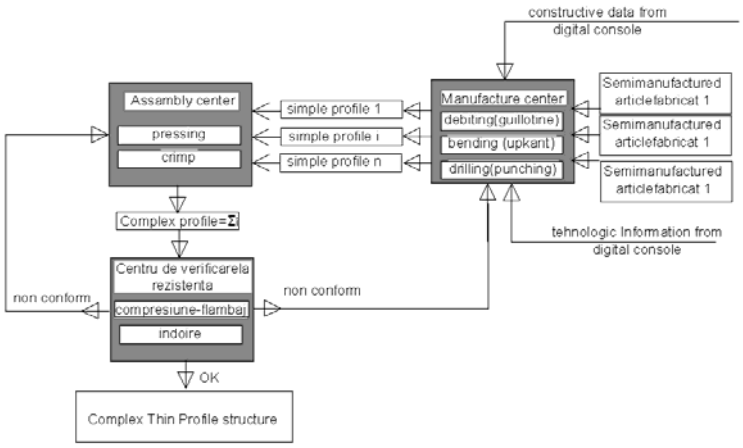

Figure 2

3.5. Description of of multitasking equipment to achieve composite profiles

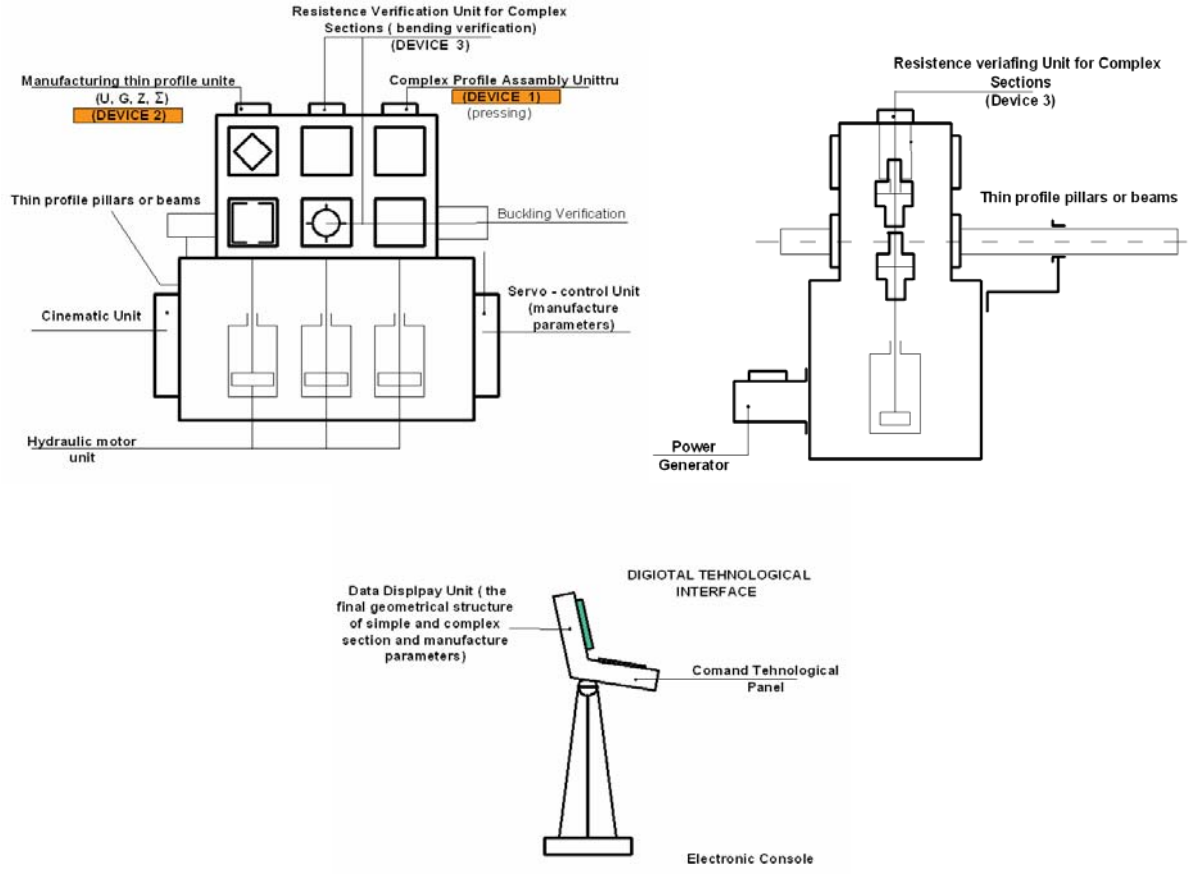

Figure 3

The structure of this equipment is presented in Fig.3 and contains:

Manufacture and assembly complex profile equipment:

Minimum 5 working place with 3 working devices (manufacturing process, assembling and resistance checking);

A power group of 5.5kW, that train a group of hydraulic linear or rotary motors in accordance with technical operation realized by devices that are connected to a mechanical kinematic system;

A control unit with electro-hydraulic classical command meant to select the technological operations;

A control unit with proportional electro-hydraulic in order to establish the working parameters in accordance with technical operations.

- Digital technologic interface:
- Mechanic-electronic consol;
- Data display;
- Data acquisition system;
- Electronic interface with manufacture equipment.
- The dedicated software package:
- Software for optimal constructive section of thin profile;
- Software to establish the working parameters of this equipment (process system).

4. Conclusions

Comparing products that our project intends to develop to those existing on the worldwide market, it can be stated that:

- Thin-walled profiles made are competitive with those existing on the worldwide market;
- The proposed technology will certify from experimental point of view, the right choice of a composed profile.

Products are distinguished from other project of the same kind that already is on the national and international market by the following characteristics:

Have a thin compose section different from those existing that will be manufacture by an multitasking equipment;

The proposed technology will be able to make an easy interface with the operator by means of a digital display, communicating the geometrical configuration of product directly to machinery and the technological parameters. In this way is eliminated the subjective factor in buoyant structure chosen and in this way is increased the exploitation safety factor.

This technology will be able to realize, besides conventional processing and profiles assembly operations and checking.

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CONTRIBUTIONS TO UPGRADING FERTIGATION TECHNOLOGIES

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Abstract: *Currently, under the conditions of a competitive market across the economy, agriculture has been forced to find new effective modern methods that lead to increased production while lowering production costs. Economic globalization, world population growth and future estimates still require the use of new methods based on innovative technologies in agriculture, as recommended by the EU, in order to increase the amount of food. In this regard research work aims to develop two modern equipment to help increase performance fertigation technology. Fertigation as is known is based on the principle fertilizing substances are distributed to plants along with irrigation water.*

Keywords*: fertigation technology*

1. Introduction

In order to achieve high producing in farming and horticulture, farms have used in recent decades a new effective method of application of fertilizers - fertirigatie - which is a modern concept in agricultural machinery, consisting of liquid fertilizing substances that are distributed along with water plants Watering.
Advantages of this method are:
- reduces production costs by eliminating equipment that manages liquid fertilizers, the fuel and labour, increase uniformity in soil, etc..
- fast access fertilising substances from plants during watering crops when needed

2. Current study on fertigation technologies abroad and in our country

Continue growing food requirements imposed new topics in applied research to develop innovative technologies in agriculture.
Abroad, fertigation technology is applied since 1970 developing into a variety of components of the plants in this area. In this respect they have produced several variants of which are in reality injector pumps driven by water pressure pipe irrigation liquid fertilizer aspiring food pipe it in the same containers and irrigation pipe. The company delivers dosing AMIAD of Israel in two versions: hydraulic piston diaphragm amplifier and multiplier. In the first case, the maximum amount injected is 320L / h and the second option has the fields: 50, 250, 600 l / h. Research in this area have led to getting these injectors performance to be operated at a low pressure of 0.5 bar allowing these products to be used in a pressure range up to 8 bar. Modern injectors were also equipped with automatic control and programmed by computer or other electronic systems. TMB diaphragms constructive version produce products that provides maximum flow 50, 250 and 600l / h but has the disadvantage of being used at a minimum pressure of 2 bar because that reduces the scope of use.

Since 1975 the company DOSATRON INTERNATIONAL - France precise dossier designed pumps in several areas: chemical irrigation, hospital hygiene, food industry, transport, water networks, printing

industry, etc.. Installed directly into the water line, working without electricity and Dosatron uses water flow pressure as a power source. Water activates the pump that takes the necessary percentage of concentrate and injects it into the water downstream. After adjusting the concentration is not necessarily another adjustment or external control. Concentrated dose is directly proportional to the volume of water flowing through the device, regardless of flow and pressure variations that may occur in irrigation pipe. High dosing accuracy eliminate the risk of overdosing, thus contributing to environmental compliance conditions.

In the country, although fertigation technology is known, the components are not manufactured by the commercial agents. There have been attempts and two prototypes were made: fertigation equipment and a device with differential pressure turbine. The equipment basically consists of a sealed metal elastomeric tank container that is a deformable that is filled with liquid fertilizer. On the irrigation pipe is mounted a diaphragm which has the upstream chamber connected to the reservoir and the one downstream to the elastic reservoir. During the irrigation water flow through the pipe, static pressure compresses the outer walls of the tank eliminating the liquid fertilizer in downstream chamber diaphragm. The method is unproductive and non-performance because the equipment must be moved manually by drag wheels with a relatively large mass 60 kg (unloaded). During travel and branching water has to be stopped from pumping station and during fertigation the liquid fertilizer concentration in irrigation water is not uniform. There are other disadvantages such as dosage adjustment is in steps and is made difficult by changing the diaphragm and the pressure loss is significantly large.

3. Modern concepts on fertigation equipment

At the basis of new fertigation technology were developed equipment which have new concepts developed and applied by specialized equipment construction companies for vegetable and horticultural culture. Here are two modern equipment:
- metering pump equipment;
- self oscillating injection equipment;

Product concept is based on the following requirements:
- Adjustable fertilizer flow widely (0.2 ...5l/min);
- Adjustment flow for a of fluid dosing pump motor operates, fertilizer injected flow remains constant;
- Works with maximum efficiency (volumetric ratio between the fluid motor (irrigation water and fertilizer than injected);
- Loss of the load due to insignificant equipment operation;
- working security;
- contains parts easily replaceable by the user;
- usage allows extrapolation to other areas.

Under the conditions of a free market and competition enters the market products with the following advantages:
- price acceptable to buyers;
- adjustable parameters fertigation request for technology;
- long life;
- reduced maintenance costs;

4. Description of modern fertigation equipment with dosing pump.

If pressurized water is in the right room, the unit consisting of two membranes, rod and slide will move to the left, will inject fertilizer through existing injection valve at the top from figure. At the same time will act on the distributor shaft and changing the position and the injection operation is repeated identically on the left side of the multiplier. While performing a race of about 20 mm a suction chamber and perform other foodpipe phase in water suction the liquid fertilizer. The operation is repeated in

reverse race. This constructive solution has the advantage of doubling the amount injected in a both ways run . The two engine rooms are alternative powered by the water pressure in the irrigation pipe through a distributor with two positions with the command pilot automatically which reverses its position. The piloting commands are activated successively pressure engine room during a round-trip flights. Regarding the construction of this inverter is composed of a drawer mobile solidarity with the crewwhile it moves axially. Drawer front rooms of the rooms receive signal hydraulic engines race to finish an order of piloting the hydraulic distributor, download the pre-existing command distributor and thus change the position reverses the direction of travel of the mobile crew.

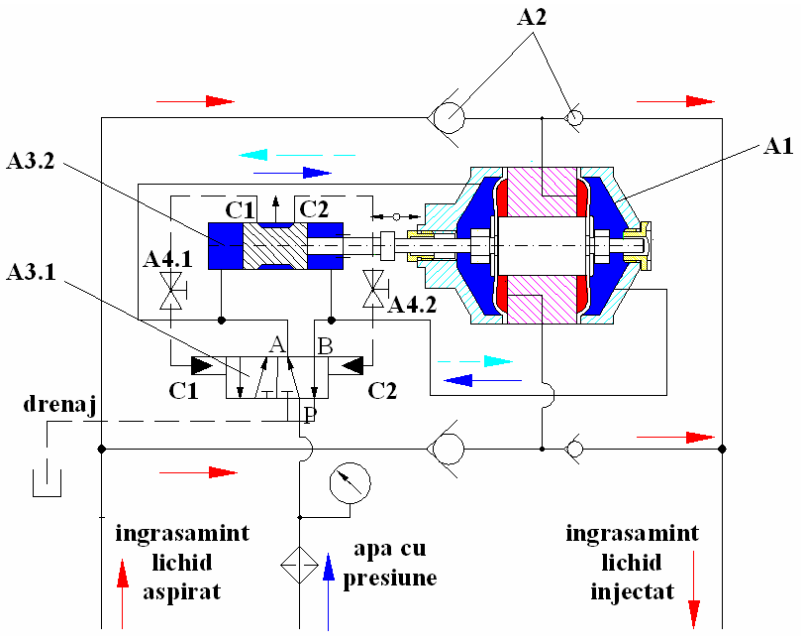

Figure 1: *hydraulic diagram in innovative version A1-multiplier, A2-block check valve A, A3.1-drive distributor, A3.2-tracking distributor, A4.1, A4.2, miniaturized valves, C1, C2 control rooms (piloting) of the distributor drive.*

General technical characteristics of equipment with dosing pump:

-Working pressure.....	P = 1...6 bar;
-Injected liquid fertilizer flow.....	Q = 0,2...4 l / min;
-Total injection race.....	c = 18 mm;
- Injection pressure.....	S = 1,5...8,5 bar;
-Volume ratio motor / pump.....	I = 3 / 1;
-Pressure loss in the supply circuit.....	Δp = 0,05 bar;
-Overall dimensions.....	300 x 145 x 300 mm;

In this way during a race aspiration occurs liquid fertilizer from a container or tank in one chamber and injected into the irrigation pipe from the other room. Note that the inverter acts as a stroke transducer whose output signal is the pressure whose value should not be amplified or converted into another

signal. Hydraulic distributor and automatically reverse the order form and drive system of the mobile crew. Frequency shift of mobile crew adjusts in two ways:
- primary - which consists in mounting pressure on the circuit, at the entrance of a slide valve distributor acts as a functional drosel;
- secondary - which consists of inserting the control circuits of the track Chokes distributor finely tuned;

Primary setting is used in case when the flow enters the distributor has the low values and secondary regulation when flow is high. Flow rate control modes are chosen so that the automatic system pressure drop to be as small as dosing pump should also act in the situation when in the water has the low pressure, about 1 bar. In the period when the existing valve and input circuit are open drosels frequency flow is maximum is the highest mobile equipment which has the effect of higher dosage amounts of liquid fertilizer plant. Concentration of fertilizer / water is governed by fertigations procedures that are based on soil, culture, degree of humidity, etc.. On the hydraulic circuit of liquid fertilizer, on both suction and discharge, valves are inserted so that open and close successively during a race double. Metering pump also contains other components such as filter pressure gauge, connecting elements, etc..

In preparing the documentation for the project team will have to choose the constructive solution so that the pump have minimal pressure drop. Therefore sizing the membranes should be so as to ensure acceptable strength and deformation. One problem with a high degree of difficulty is the choice of materials because they must be resistant to corrosion since the medium is water and chemical fertilizers. Materials used must be common, easily available and cheap.

The entire product must be lightweight easily transportable to branching points of the irrigation pipe. Constructive solution, manufacturing technology and materials must lead to making a product with a long life, high-maintenance period, the price of cost borne by businesses, etc..

5. Autooscilant injection equipment description.

This modern equipment proposed for assimilation does not need power because it is driven by a pressure linear motor in the irrigation pipe. Parts are resistant to all chemicals used (herbicides, insecticides, fungicides, fertilizers) in agriculture and horticulture. It is designed to withdraw the open or closed tanks with capacity less than 1000 l. This equipment has the advantage that the dosage can be controlled by an electronic system when using solar panels.

Technical data:
- range of injection: 9 ... 320 l / h;
- operating range: 0.5 ... 6 bar;
- weight: 5 pounds;
- adjustable injection rate;
- volume ratio motor / pump: 3 / 1

Injection rate is kept constant in operation during the mechanism and imply the application the fertigation technology but can be adjusted at the beginning of the activity. Injection rate values for certain sizes is done by inserting on the suction flow of the liquid chemical fertilizers of flow control. If the pressure irrigation equipment falls below 0.5 bar automatically stops. operation can The stopping be done by external control by manual operation of a button.

Very low weight gives the advantage of being easy manual transportation in areas difficult to reach and in greenhouses. Another advantage is the functioning at low pressure of 0.5 bar so it can be

powered by gravitational potential energy is a quantity of existing water in a tank located at a height greater than 5 m so that this mechanism can be used by small farmers.

Equipment with self oscillating injector composition and working:

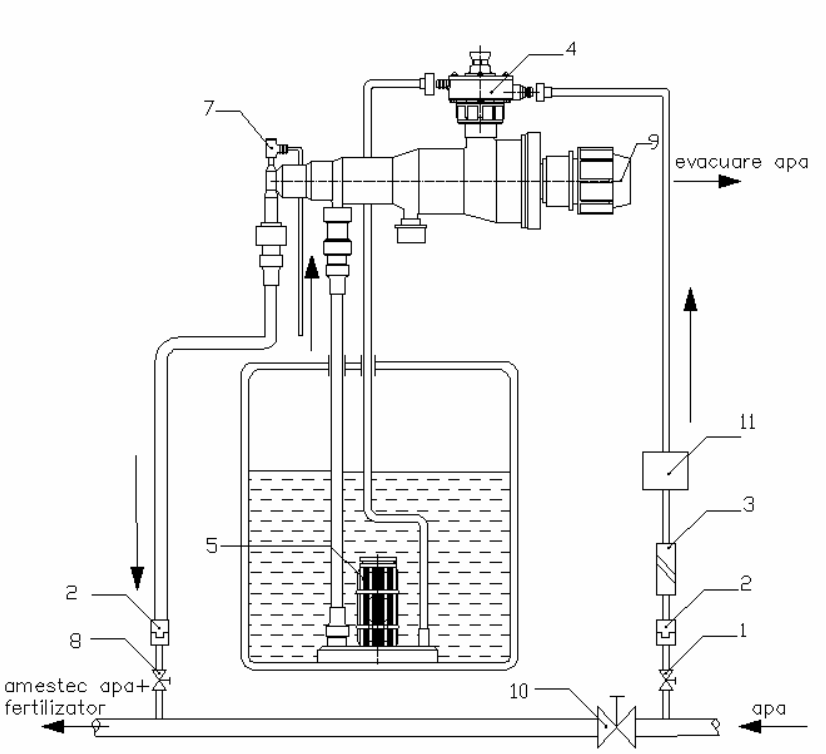

Figure 2. *1.8 - intercepting valves, 2 - rapid coupler, 3 - filter, 4 - on-off automatic button, 5 - fertilizer filter with automatic locking, 7 - vent valve, 9 - water outlet, 10 - special regulation valve, 11 - flow regulator*

After connecting the mechanism and opening the vent valves 1.8 is performed by opening the hydraulic circuits and then close the vent valve 7. Under the action of pressure pipe from the irrigation water pump / motor assembly execute a self-oscillating movement which has the effect of suction filter with automatic locking fertilizer through 5. Downstream discharge is made by rapid coupling valve 2 and 8. Injection rate adjustment is performed by fitting flow regulators 11.

6. Conclusions

Use these productions modern equipment allows a with 50% increase compared with traditional procedures used in conventional technologies.

It will also enhance competitiveness of agriculture in terms of valuing these products due to the ability to stand the test of the new product market (direct exposure to the most demanding customers), in favorable conditions, resulting in increased productivity and living standards.

Will increase the capability of firms that produce these products to address market demand as a result of social needs, and contribute to the development of national economy competitive through quality, to meet the current trends of international trade (globalization of markets through the creation of markets

and their strong regional powerful expansion, standards-based international / regional and multilateral cooperation agreements).

Increased competitiveness will lead to profitability and to invest sufficient economic initiative, to replace obsolete equipment, to integrate in advanced technologies.

Use of fertigation technology has a positive impact on the environment - soil and water as it meets for protection of waters against pollution by nitrates from agricultural sources.

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"PREGATIREA SPECIALISTILOR IN DOMENIILE MECANICII, HIDRAULICII SI PNEUMATICII IN SCOPUL PROMOVARII ADAPTABILITATII SI CRESTERII COMPETITIVITATII" POSDRU/81/3.2/S/47649

Proiectul "Pregatirea specialistilor in domeniile mecanicii, hidraulicii si pneumaticii in scopul promovarii adaptabilitatii si cresterii competitivitatii" este co-finantat din Fondul Social European, prin Programul Operational Sectorial Dezvoltarea Resurselor Umane 2007-2013, Axa prioritara 3 "Cresterea adaptabilitatii lucratorilor si a intreprinderilor", Domeniul major de interventie 3.2. "Formare si sprijin pentru intreprinderi si angajati pentru promovarea adaptabilitatii".

Solicitant: Camera de Comert si Industrie Valcea
implementeaza proiectul alaturi de partenerii:
Partener 1: Asociatia Profesionala de Hidraulica si Pneumatica din Romania – Fluidas
Partener 2: Universitatea Tehnica din Cluj-Napoca
Partener 3: Universitatea Tehnica "Gheorghe Asachi" din Iasi
Partener 4: PIA e.V. – Development and Assessment Institute in Waste Water Technology at RWTH Aachen University – Germania

CORELAREA PREGATIRII IN ROMANIA CU MODALITATILE EUROPENE DE PREGATIRE

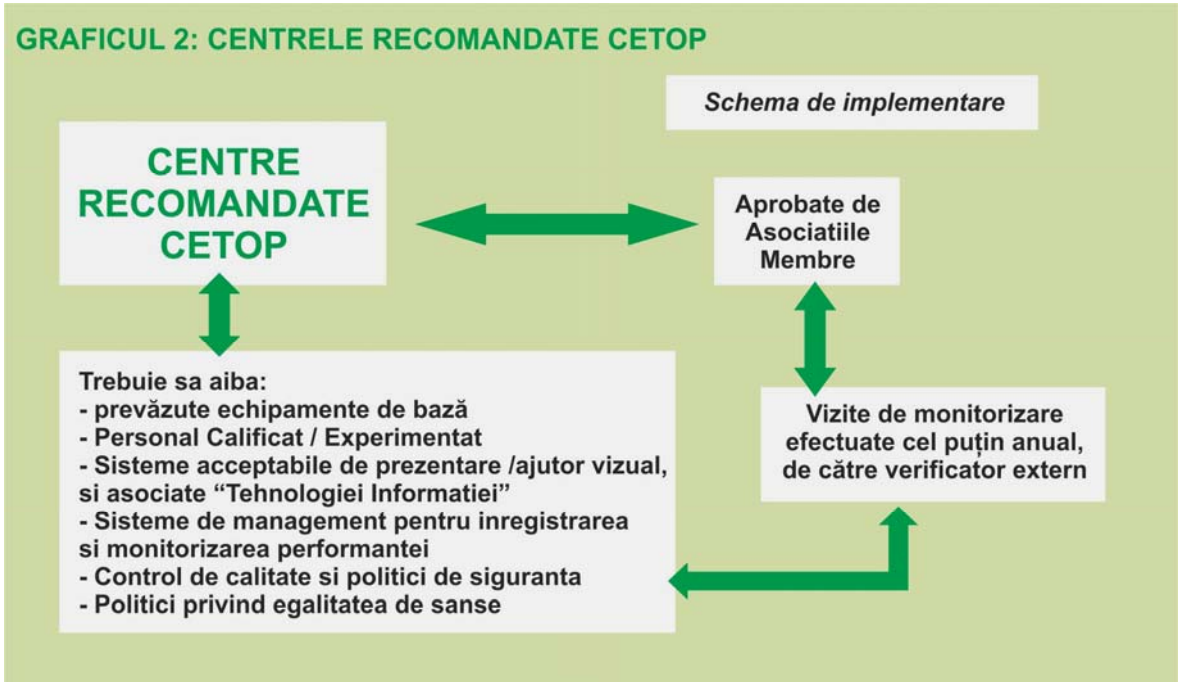
In Romania acest proiect este primul in care se dezvolta o retea de Centre de pregatire si perfectionare profesionala, retea ce va fi recunoscuta de Forurile competente din Europa.
Initiativa va permite angajatorilor sa identifice nivelele de competenta, aptitudinile, si cunostintele unei persoane care detine un certificat de competente CETOP, si furniza o garantie marita a asigurarii calitatii pe parcursul activitatii.
Calificarile CETOP trebuie sa devina o referinta in educarea si formarea in actionarile hidraulice din Europa, si totodata sa asigure oportunitati marite pentru angajari si transfer de aptitudini in interiorul Europei.

Responsabilitatea implementarii si managementul armonizarii programului (odata dezvoltat si aprobat) va fi a Membrilor Asociatiei CETOP.

Este recomandat ca fiecare membru sa colaboreze cu diverse institutii de invatamant si formare din interiorul tarii, ca sa se asigure ca toate aspectele de asigurarea calitatii, validare si verificarea sunt conforme recomandarilor CETOP.

Intenia este ca fiecare membru CETOP sa atinga in structura invatamantului national punctele dorite, oferiind fiecarei organizatii flexibilitate si control total pentru a dezvolta si implementa modalitatile necesare pentru atingerea obiectivului

Membrii asociatiei vor fi de asemenea responsabili pentru recomandarea si avizarea organizatiilor de instruire sa realizeze propunerea si sa asiste companiile membre in asigurarea si sutinerea resurselor necesare.



Fiecare membru CETOP va inmana certificate individuale care sa ateste nivelul de pregatire dobandit. Acest certificat va reprezenta o calificare recunoscuta pe plan european.

Pe durata perioadei de studiu si de dobandire a competentelor, toti candidati vor fi obligati sa mentina un raport individula de aptitudini. Acesta ar trebuii sa formeze un portofoliu al cunostintelor si competentelor obtinute, apartinand nivelului ocupational personal. Toate aceste rapoarte trebuiesc semnate pentru autenticitate si vor deveni bazele dezvoltarii profesionale continue.

Va fi resaponsabilitatea „Centrelor recomandate" sa asigure informare si indrumare referitor la nevoile personale, luand in considerare notiunile si experienta precedenta.

Aceasta nu inseamna ca o persoana cu nivel ocupational 3 este capabil sa urmeze un program de studiu de nivel 3. Persoane diferite, vor avea nevoie de pregatire educationala si profesionala diferita depinzand de:

a – cunostintele actuale, aptitudinile, experienta, si statutul salarial, somer sau angajat

b – asteptarile angajatorului in functie de incadrarea la locul de munca sau de aptitudinile doritela locul de munca (de exemplu: pentru un absolvent in domeniul electronic este necesara o cunostere sumara in domeniul hidraulicii, astfel incat o instruire de nivelul 1 ar putea satisface nevoile persoanei respective)

Centrele de formare trebuie sa asigure oportunitati egale candidatilor la toate nivelurile, si sa asigure diferite metode de instruire, variind de la:

- Cursuri scurte si module
- Program de invatamant la distanta
- Studiu personal

GRAFICUL 3: METODE RECOMANDATE DE EVALUARE

METODE DE EVALUARE PENTRU CALIFICARE BAZATE PE COMPETENTE

"Cunoasterea si intelegerea" este evaluata printr-o serie de sarcini scrise care duc la o EXAMINARE SCRISA

"Cunoasterea, intelegerea si APLICAREA" sunt evaluate printr-o serie de SARCINI BAZATE PE COMPETENTE, referitoare la un anumita "functie-cheie" de exemplu: instalatie , punerea in functiune, diagnosticarea erorii. Acest lucru se realizeaza in mod INDIVIDUAL, cu un evaluator autorizat. Succesul este bazat pe un minim de doua performante sub conditii si criterii diferite.

Probele vor include observarea directă de către evaluator, întrebări si rapoarte scrise. Succesul se bazează pe o performanta satisfacatoare din partea candidatului, acesta fiind EVALUAT OBIECTIV.

Programele pot fi FLEXIBILE sau urmand SISTEMUL TRADITIONAL DE EDUCATIE. Deasemenea CUNOŞTINȚELE ANTERIOARE ŞI EXPERIENȚA trebuiesc luate in considerare. Evaluarea se realizeaza doar în cazul în care candidatul este pregatit si evaluatorul / tutorele este convins că au fost dobândite suficiente cunoştinţe şi pricepere pentru a asigura succesul examenului.

Pentru ca aceasta „Initiativa armonioasa" sa fie implementata cu succes si sa fie eficienta, este nevoie ca toti membri asocoatiei CETOP sa stabileasca in interiorul tarilor lor proprii, o serie de programe bazate pe competente care sa o varietate de domenii si subiecte asociate. Trebuie sa colaboreze indeapropape cu unitati de invatamant, unitatile industriale principale, IMM'uri si alti utilizatori, pentru a asigura ca programul respecta necesitatile, in functie de evolutia standardului ocupational si a tehnologiei aflate intr-o continua schimbare.

Pentru detalii suplimentare va rugam sa ne contactati la:
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UN NOU PROGRAM DE FINANTARE PENTRU CERCETARE SI INOVARE LA NIVELUL UE - ORIZONT 2020 -

Comisia Europeana a anuntat ***lansarea programului Orizont 2020 pentru investitii in cercetare si inovare, cu un buget de 80 de miliarde euro,*** un pachet de masuri pentru stimularea cercetarii, inovarii si a competitivitatii in Europa. In paralel, a fost anuntat un program complementar nou, destinat sa stimuleze competitivitatea si inovarea la nivelul IMM-urilor, cu un buget suplimentar de 2,5 miliarde euro. Programele de finantare se vor derula in perioada 2014-2020.

Orizont 2020 reuneste pentru prima data in cadrul unui program unic toate fondurile UE destinate cercetarii si inovarii, concentrandu-se asupra transformarii descoperirilor stiintifice in produse si servicii inovatoare care ofera oportunitati de afaceri si imbunatatesc viata oamenilor.

Programul Orizont 2020 va orienta fondurile catre ***trei obiective principale:***

- Pentru sprijinirea pozitiei UE ca lider mondial in domeniul stiintei se aloca un buget de 24,6 miliarde euro, care include o crestere cu 77% a fondurilor alocate Consiliului European pentru Cercetare pentru succesele obtinute.
- Pentru contributia la asigurarea primatului industrial in domeniul inovarii se aloca un buget de 17,9 miliarde euro care include o investitie majora de 13,7 miliarde euro in tehnologii cheie, precum si un acces sporit la capital si sprijin pentru IMM-uri.
- Se vor aloca fonduri de 31,7 miliarde euro pentru abordarea principalelor preocupari comune tuturor europenilor, impartite in 6 teme-cheie: sanatatea, schimbarile demografice si bunastarea; securitatea alimentara, agricultura durabila cercetarea in domeniul marin si maritim si bioeconomia; sursele de energie sigure, ecologice si eficiente; mijloacele de transport inteligente, ecologice si integrate; combaterea schimbarilor climatice, utilizarea eficienta a resurselor si materiile prime, precum si societatile sigure, inovatoare si incluzive.

Finantarea oferita de programul Orizont 2020 va fi mai usor accesibila datorita faptului ca acest program are o structura mai simpla si prevede un singur set de norme si mai putina birocratie. Orizont 2020 va insemna: simplificarea considerabila a rambursarii prin introducerea unei rate forfetare unice pentru costurile indirecte si a numai doua rate de finantare - pentru cercetare si, respectiv, pentru activitati de piata, un punct unic de acces pentru participanti, mai putine formalitati administrative in pregatirea propunerilor si renuntarea la toate controalele si auditurile inutile. Un obiectiv-cheie este reducerea cu 100 de zile, in medie, a intervalului de timp dintre solicitarea unui grant si primirea finantarii, ceea ce inseamna ca proiectele pot fi initiate mai devreme.

Comisia va depune eforturi majore pentru ca programul sa devina accesibil mai multor participanti din intreaga Europa, prin explorarea eventualelor sinergii cu fondurile alocate in cadrul politicii de coeziune a UE. Orizont 2020 va identifica potentiale centre de excelenta in regiunile cu performante slabe si le va oferi acestora consiliere si sprijin in materie de politica, in timp ce fondurile structurale ale UE pot fi utilizate pentru modernizarea infrastructurii si a echipamentelor.

Se vor aloca fonduri de 3,5 miliarde euro pentru diversificarea si extinderea utilizarii unor instrumente financiare care sa faciliteze atragerea de imprumuturi de la institutiile financiare din sectorul privat. Acestea s-au dovedit a fi extrem de eficiente in ceea ce priveste stimularea investitiilor private in inovare, care determina in mod direct cresterea economica si crearea de locuri de munca.

Intreprinderile mici si mijlocii (IMM-urile) vor beneficia de aproximativ 8,6 miliarde EUR, ceea ce reprezinta o recunoastere a importantei rolului lor in procesul de inovare.
Orizont 2020 va investi aproximativ 6 miliarde euro in dezvoltarea capacitatilor industriale europene din domeniul tehnologiilor generice esentiale (TGE). Printre acestea se numara: fotonica, microelectronica si nanoelectronica, nanotehnologiile, materialele avansate, sistemele avansate de fabricatie si de prelucrare si biotehnologia.
Ca parte integranta din programul Orizont 2020, EIT va juca un rol important prin reunirea celor mai bune institutii de invatamant superior, centre de cercetare si intreprinderi pentru a crea antreprenorii de maine si pentru a garanta ca „triunghiul cunoasterii” europene se ridica la nivelul celor mai bune din lume. EIT se bazeaza pe conceptul inovator de platforme transfrontaliere de parteneriat public-privat, denumite Comunitati de cunoastere si inovare (CCI). La cele trei CCI existente, axate pe domeniul energiei durabile (CCI InnoEnergy), al schimbarilor climatice (CCI Climate) si al societatii informatiei si comunicatiilor (EIT ICT Labs), se vor adauga sase CCI noi in perioada 2014-2020.

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AN ALTERNATIVE FOR ACCELERATING R&D:

TEXAS INSTITUTE OF SCIENCE

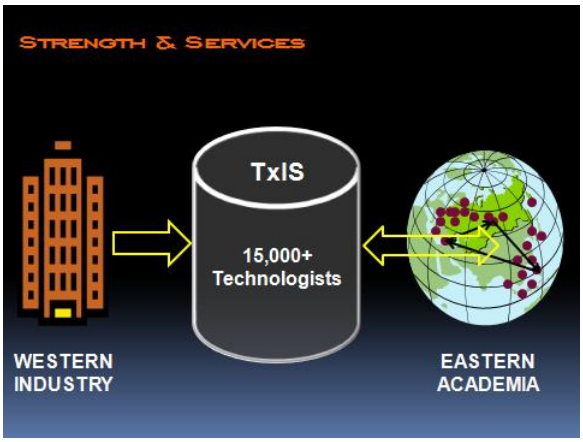
With a strong oil and gas industry and scarce human resources, the research community, like the producing sector, is challenged with accomplishing needed R&D and product development quickly and in a cost-efficient manner. Accelerating technology development is key for the developer to receive a return on investment. On the user side, the technology must be applied to realize opportunities and solve problems. An alternative, developed by the Texas-based, for Profit Corporation in 2006, Texas Institute of Science (TxIS), delivers faster time to market with significant cost savings.

TxIS relies on the Institute's Global Research Alliance, consisting of 15,000+ professors and research scientists in 1800+ departments at 192 affiliated universities and research institutes. 95% of TxIS's technologists are located in Eastern Europe, Turkey, and the former Soviet Union. Others are located in South Korea, Hong Kong, Taiwan, and China. TxIS maintains close relationships with the affiliated scientists, and is the only global operation that successfully leverages these Eastern scientific resources on behalf of Western industries.

TxIS provides excellent research, development, and application-science projects to its partner universities, research institutes, professors, and scientists. In addition, the Institute also provides other services such as financing for new technology or innovation, commercial evaluation, and finding markets for newly developed technologies.

The core of the business model involves assembling a real-time, multi-phase, multi-site and multi-discipline "virtual research group" connected and communicating through the Internet, tailoring the group's activities to the client's project, and actively managing the project to its successful conclusion. Typical clients are those whose success depends on an ever improving technology, but have limited engineering/science resources to produce the required technology. In addition to geophysics and exploration, TxIS's areas of expertise include signal processing, mechanical & material sciences, nanotechnology, communications technology, and robotics. In 2012, TxIS plans to expand to include projects in other disciplines as well, such as in the food and medical fields.

The TxIS Global Alliance network of 15,000+ scientists provides great flexibility in tailoring disciplines and identifying/selecting experts to specifically fit the client's needs. If rush jobs are required, "parallel research groups" can be assembled. Historically, the proven time-to-market is about 25% faster than a traditional scientific group. Clients and researchers communicate directly, but TxIS assumes full responsibility for completing the program on time and at budget. Ownership of all created patents belongs to the clients. Typical projects are Technology Trend White Papers. As many companies do not establish "Technology Trend" departments, aiming and guiding new research properly can be challenging. Knowing exactly which research was previously unsuccessful, as well as where technology is going, helps companies to avoid critical missteps that may be costly, if not fatal, to technology development efforts. A company may work on new research for a year before finding out that component vendors took a different route, or that the research has gone in another, more productive, direction.



Eight out of ten projects at TxIS start with a Feasibility Study. This gives the client a chance to decide which of the TxIS recommended solutions is the most advantageous to pursue. By taking on projects on a step-by-step basis, we can almost guarantee success; we go into projects with our eyes wide open and help clients mitigate the risks. On average, within two hours of the client sending a project description, the project management team already knows the most probable resources for the project, and within four to six days, the plan is in place.

TxIS has a well-designed contract flowchart when it takes on a new project. The most important factor is that TxIS, not the client, manages the parties. Both resource and Client sign a contract and Non-Disclosure Agreement (NDAs) with TxIS; financing and payment flow the same way.

One of the most critical issues for TxIS is confidentiality and document control. Clients bring their best ideas, technology plans, objectives, and many times their problems to TxIS. We therefore have an extremely tight document control system. All of the TxIS scientists are under NDA, and in addition, their organizations are inspected by the regional TxIS offices.

Once a project starts, TxIS opens up all communication channels between the Clients' engineers and the Institute's scientists. Lead scientists usually visit directly with the client because this is the best way for people to work together. When the project is complete and the result turned over, all credits, publications, announcements belong to the clients' Engineering Department. The TxIS staff and scientists have the attitude that they are invited in by the engineering department to work under their direction and augment their existing force, and therefore the recognition belongs to them.

Case Studies, which include a small sampling of our work, may be found on the TxIS website (www.txis.us). The following disciplines are in the highest demand:

Corrosion	Coating
Metallurgy	Material Science
Chemistry	Drilling
Nano-structures	Mechanical Issues
Measurements	Fluid Dynamics
Gas Dynamics	Surface Problems
Algorithms	Modeling
Seals	Cryogenic Problems
Sensor Technologies	Welding

Those interested in becoming a part of the TxIS Global Research Alliance may send an email to technology@txis.us.

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The 8th International Conference on Fluid Power (8th IFK) will be held in Dresden from 26 to 28 March 2012. The IFK is one of the world's most significant scientific conferences on fluid power control technology and systems. It offers a common platform for the presentation and discussion of trends and innovations to manufacturers, users and scientists. The symposium on the first day is dedicated to presentations focused on methodology and fundamental research. The two following conference days offer a wide variety of application and technology orientated papers about the latest state of the art in fluid power. It is this combination that makes the IFK an unique and excellent forum for the exchange of academic research and industrial application experience. An exhibition taking place simultaneously offers the possibility to get product information and to have individual talks with manufacturers. The conference is followed by two days of excursions to regional companies and technical sights. The relevance of fluid power in machinery and plant engineering is immense. Driven by the challenges of rising commodity prices, a responsible use of resources, the competition with electric drives and not least the legal framework, the manufactures and users take the next steps of development offensively. The consequent improvement of technology in terms of energy efficiency, energy recovery and environmental compatibility plays a particular role. With innovative approaches the fluid power industry emerges confidently from the crisis and manifests itself again as motor of the drive and control branch.

This is reflected in the variety of conference topics, which are themed ***"Fluid Power Drives!"*** .

Please use the template available at www.ifk2012.com.

The IFK addresses to application-oriented topics in the field of industrial hydraulics, mobile hydraulics and pneumatics as well as innovations in fluid power components. Moreover, articles about specific applications, renewable energies, fundamentals, tribology, materials and machine availability and safety are welcome. The important aspect of education and further training in the fluid power branch is also addressed for the first time to the 8th IFK. The conference topics are suggestions for the papers. Unconventional contributions are explicitly welcome! Further information is available under www.ifk2012.com. The IFK team led by Prof. Jürgen Weber looks forward to receiving a lot of interesting papers for the 8th IFK 2012 in Dresden.

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