

**Prof. Ing. Massimo Milani**massimo.milani@unimore.it

Department of Engineering Sciences & Methods

Phone +39 0522 522 223

Faculty of Engineering in Reggio Emilia

Fax +39 0522 522 609

Via Amendola, 2 – Morselli Pavilion

Mobile +39 331 655 0514

42100 Reggio Emilia – ITALY

CURRICULUM VITAE**Personal information**

Address	Office	Via Amendola 2, Morselli Pavilion – 42100 Reggio Emilia – ITALY	
Telephone	Office	+39 0522 522 223	Mobile: +39 331 6350514
	Fax	Office +39 0522 522 609	
E-mail	massimo.milani@unimore.it		
Nationality	Italian		
Date of birth	22 nd of September 1968		
Family	Married with Elisabetta (bank employer). His daughter, Dania, is 7 years old		

Work Experiences

01.12.2005 today	Associate Professor of Fluid Power Systems and Components SSD ING/IND 08
Educational Activity	Faculty of Engineering in Reggio Emilia – Mechatronics Engineering
Research Activity	Department of Sciences and Methods for Engineering
Employer	University of Modena & Reggio Emilia
01.11.1999 30.11.2005	Research Assistant of Fluid Power Systems and Components SSD ING/IND 08
Educational Activity	Faculty of Engineering in Modena – Mechanical Engineering
Research Activity	Department of Mechanical and Civil Engineering
Employer	University of Modena & Reggio Emilia
01.11.1995 31.10.1998	Ph. D. Student SSD ING-IND/08
Research Area	Fluid Power Systems and Components
Organization	Department of Mechanical and Civil Engineering – University of Modena



Education and Training

21.12.1998	Ph. D. Degree in Materials Engineering
Organization	Department of Mechanical and Civil Engineering – University of Modena
Judgement	Optimum

22.12.1994	Master Degree in Materials Engineering
Organization	Faculty of Engineering – University of Modena
Vote	107/110

Personal Skills and Competences

Mother tongue	Italian				
Self-assessment	Understanding		Speaking		Writing
European level (*)	Listening	Reading	Interaction	Production	
English	B1-B2	B1-B2	B1-B2	B1-B2	B1-B2
French	A1	A1	A1	A1	A1

(*) *Common European Framework of Reference for Languages*

Programming and PC tools	Familiar with most common scientific languages (C++, VisualBasic) MATLAB: good LMS-AMESim: Excellent MS-Office tools: Excellent
Driving License	B – Automobile and Bikes
Hobbies	Books (novel, thriller, historical and epic) Sport (football, tennis and playground with my daughter) Dinner with friends Act as volunteer within No-Profit Organization for Parentless Children Aid

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RESEARCH INTERESTS

Academic Assignments and Affiliations	
from Dec. 2009 till now	Deputy Director Engineering Sciences and Methods Department University of Modena and Reggio Emilia
from March 2010 till now	Member of the Scientific Committee EN&TECH Inter-Departmental Research Center University of Modena and Reggio Emilia
from Dec. 2010 till now	Member of the Steering Committee ENA – Energy & Ambient Research Platform ASTER – Regional Agency for Research and Technological Transfer
from March 2010 till now	Member of the Product Development Committee Mechanics & Materials Research Platform ASTER – Regional Agency for Research and Technological Transfer
from Sept. 2007 to October 2009	Faculty Delegate Students Guidance and Tutoring Services Faculty of Engineering in Reggio Emilia University of Modena and Reggio Emilia
from Sept. 2007 to October 2009	Delegate for Community Relations Engineering Sciences and Methods Department University of Modena and Reggio Emilia
from 2003 till now	Member of the Scientific and Organizing Committee Second Level Master in Fluid Power University of Modena and Reggio Emilia
from June 2007 to June 2010	Scientific Delegate Inter-Departmental Strategic Plan Development “Mechatronics Systems for Automotive Applications” University of Modena and Reggio Emilia
from January 2006 till now	Member of the Scientific Committee Ph. D. Course in Industrial Innovation Engineering Engineering Sciences and Methods Department University of Modena and Reggio Emilia
from October 2008 to September 2011	Scientific Coordinator International Cooperation Agreement with Maha Fluid Power Research Center Purdue University, Indiana, USA Co-Coordinator: Prof. Ing. Monika Ivantysynova

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from October 2008 to September 2011	<p>Scientific Coordinator International Cooperation Agreement with the Institute of Machine Design Johann Kepler University – Linz, Austria Co-Coordinator: Prof. Ing. Rudolf Scheidl</p>
from January 2009 to December 2012	<p>Scientific Coordinator International Cooperation Agreement with the Institute of Mechatronics Lappeenranta University of Technology – Lappeenranta, Finland Co-Coordinator: Prof. Ing. Heikki Androos</p>
2003 – 2005	<p>Technical Coordinator of the work-package <i>Fluid Power for Mechatronics LAB</i> MECTRON Project – Emilia Romagna Regional Platform for Industrial Research and Technological Transfer</p>
2006 - 2008	<p>Scientific Coordinator of the work-package <i>Oleotronic LAB</i> INTERMECH Project – MECTRON LAB Emilia Romagna Regional Platform for Industrial Research and Technological Transfer</p>
2009 - 2013	<p>Scientific Coordinator of the work-package <i>OleoMechatronics</i> TECNOPOLO Project – INTERMECH-MECTRON LAB Emilia Romagna Regional Platform for Industrial Research and Technological Transfer</p>
from July 2008 till now	<p>Scientific Representative at Fluid Power Net International Department for Engineering Sciences and Methods University of Modena and Reggio Emilia</p>
from December 2005 till now	<p>Scientific Coordinator of the HY.draulic SY.stem DE.sign Laboratory Department for Engineering Sciences and Methods University of Modena and Reggio Emilia</p>
From July 2010 till now	<p>Scientific Coordinator of the ENERCLEAN Project MISE Industria 2015 – Made in Italy Department for Engineering Sciences and Methods University of Modena and Reggio Emilia</p>
from September 2010 till now	<p>Scientific Coordinator of the Fluid Power for Mechatronic Lab Reggio Emilia Innovazione S.c. a r.l.</p>
from 2001 till now	<p>Reviewer International Journal of Fluid Power</p>
from November 2005 till now	<p>Member SAE International, Fluid Power Systems and Components Division</p>
from November 2005 till now	<p>Member Organizing Committee, Session Organizer and Session Chairman SAE Commercial Vehicle Congress and Exposition</p>

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National and International Research Link

IMAMOTER – CNR Ferrara – Italy	Dr. Gianluca Zarotti Dr. Roberto Paoluzzi	Institute of Hydraulic Drive Johann Kepler University Linz - Austria	Prof. Rudolf Scheidl
Turin Politechnic Turin – Italy	Prof. Nicola Nervegna	Institute of Mechatronics University of Technology Lappeenranta - Finland	Prof. Heikki Handroos
MAHA Fluid Power Lab Purdue University West Lafayette – IN - USA	Prof. Monika Ivantysynova	Institute of Mechatronics Danish Technical University Lingby - Denmark	Prof. Ing. Finn Conrad

National and International Research Programs

<p>Esprit Project SWING 1998/99</p>	<p>The acronym SWING indicated “<i>Simulation in Fluid Power System as a Tool for Virtual Prototyping in a Concurrent Engineering Environment</i>”. The purpose of the project was to test the implementation of advanced modelling and simulation tools on a group of SMEs, in order to drastically reduce time and human involvement in critical design phases, to strongly improve their flexibility and capability in reducing development costs and time-to-market. SWING involved seven partners from Italy and four partners from Norway, and it was addressed to the concurrent engineering application of CAE design tools to the optimization of fluid power components. The main results obtained as Scientific Coordinator and Technical Manager of a 18 months (40 k€) work-package devoted to the design of proportional directional control valves were:</p> <ol style="list-style-type: none"> 1. the development and the tailoring of a MATLAB© based tool with enhanced GUI for the design of multiple notched edges; 2. the development and the tailoring of a MATLAB© based tool with enhanced GUI for the design of open centre proportional directional control valve; 3. the development of an innovative experimental methodology for the determination of axial and radial flow-forces acting on spools of proportional directional control valves.
<p>MURST Young Researcher 1999/00</p>	<p>Funded on a special program for young researchers of the Italian Ministry for University and Scientific and Technological Researches (20 k€), this one and a half year project was addressed to the “<i>Numerical Modelling of Multi-Phase Flows</i>”.</p> <p>More in details, the project took the basis from a comprehensive review of study about multi-phase and multi-component flows, and the most important results were achieved developing:</p> <ol style="list-style-type: none"> 1. a lumped and distributed parameter numerical model for the prediction of multi-component flows under strong pressure gradient in hydraulic component; 2. a multi-dimensional numerical model for the prediction of air and vapour bubbles release in hydraulic fluids;

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MURST**Young Researcher****2000/01**

3. a lumped and distributed parameter numerical model for the prediction of aeration and cavitation in hydraulic systems and components.

Funded on a special program for young researchers of the Italian Ministry for University and Scientific and Technological Researches (20 k€), this one and a half year project was addressed to the “*Industrial Pipes and Hoses Dynamic Instability*”.

The research main topic was the study of pressure pulsations, and the main results were achieved developing simplified numerical models for:

1. the prediction of the influence of pressure and temperature on hydraulic fluid properties variation;
2. the prediction of the equivalent bulk modulus and of the celerity of a wall-fluid system with the variation of the pipe/hose constraints;
3. the prediction of the influence of hydraulic pumps flow-rate characteristic pulsation on pressure transients in pipes and hoses.

REM PRRITT**MECTRON****2005/07**

To improve the regional industrial innovation and to promote the research cooperation for technological transfer, in 2005 the Region Emilia Romagna funded a project dedicated to the implementation of a regional platform dedicated to high-tech mechanics: HI-MECH.

The platform, involving the most important regional technological fields (automotive, automation, power transmission, food industries, ...), led to the organization of seven thematic tech-net-labs. Among others, the net-lab MECTRON was devoted to mechatronics applications, and a research project articulated in five work-packages was funded for a total budget of 3,0 M€.

The work-package “*Fluid Power for Mechatronics LAB*” was addressed to the organization of a competence center dedicated to the CAE design and to the experimental characterization of fluid power machines and components. The main results achieved as Technical Coordinator of the work-package were:

1. the activation of 3 three-years research fellowship grants, for a total investments in human resources of 240 k€;
2. the design and the implementation of a 32 kW re-generative test bench for hydraulic pumps and motors characterization, for a total investment of 80 k€;
3. the design and the implementation of a 25 kW test bench for on/off and proportional control valves characterization, both in terms of steady-state and of dynamic performance, for a total investment of 60 k€;
4. the design and the implementation of a multiple channel (16) real-time acquisition system based on the National Instrument technology, for a total investment of 20 k€;
5. the implementation of a section for CAE design applied to fluid power systems and components, for a total investment of 40 k€.

REM PRRITT**INTERMECH****2008/09**

At the end of the start-up phase, the support to regional platform devoted to high mechanics has been prolonged for 18 months, through the activation of a special project dedicated to net-lab interconnection.

Within INTERMECH, which started in January 2008, the activities of the work-package “*Fluid Power for Mechatronics LAB*” were oriented to the expansion of scientific connections among the research units involved, and to the strengthening of equipments and test benches. The main results achieved as Scientific Coordinator can be summarized as:



UNIVERSITÀ DEGLI STUDI
DI MODENA E REGGIO EMILIA

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1. the activation of one 18 months research fellowship grants, for a total investments in human resources of 30 k€;
2. the development and the tailoring of a methodology for the fast image processing application to hydraulic flows monitoring, by the use of air inoculation or solid particle injection;
3. the design of transparent prototypes for internal flow field visualization, for a total investment 15 k€;
4. the design and the implementation of a 6 kW power supply (5 k€);
5. the acquisition of a complete set of transparent hydraulic components for didactic and research purposes (20 k€).

**REM PRRITT
TECNOPOLO
2009/13**

The project named TECNOPOLO represents the final act of Emilia Romagna Region PRRITT to complete the net of high-tech laboratories devoted to industrial research and to technological transfer.

For the purposes of this project, the Department for Engineering Sciences and Method represents the centre of gravity for research activities dedicated to mechatronics.

The five years project is planned to start in the second part of 2009, and it will address to DISMI a total funding of 9 M€ (about 3 M€ for new buildings and laboratories, about 3 M€ for recruitment and 3 M€ for test-benches and lab equipments).

Within the TECNOPOLO the work-package “*Oleotronics*” will activate a research line intended to consolidate the activities and the competences in the field of fluid power system and components, and the following main investments have been budgeted:

1. Oleotronic Lab new building (about 500 k€ for about 200 sqm for experimental equipments allocation, 100 sqm for offices and CAE design lab, and 100 sqm for education and training);
2. 1 five years grant for the recruitment of research assistants (ab. 150 k€);
3. 2 three years grant for the recruitment of young researcher (120 k€)
4. test bench for hydrostatic transmissions characterization, (60-80 k€);
5. test bench for hydraulic components high operating temperature (80-120 °C) characterization (60-80 k€);
6. test bench for multiple actuation systems characterization (40-60 k€).

**MID
INDUSTRIA 2015
2010/13**

ENERCLEAN is a three years research project submitted to the “*Industria 2015 – New Technologies for the Made in Italy*” Call of the Italian Ministry for Industrial Development.

This collaborative project is still under evaluation to be admitted to a 50% co-funding, and it derives from an original idea (patented in 2008) aimed to the development of a novel energy conversion system based on the products of the combustion of a metallic fuel with water.

The project is articulated in five work-packages over a period of 36 months, and it involves consortium including seven industries, four public research centres and the cooperation of one foreign department, for a total investment of about 11 M€ (450 k€ assigned for the activities development at DISMI).

**International
Cooperation**

In October 2008 the University of Modena and Reggio Emilia, through its Department for Engineering Sciences and Methods, and the Purdue University, through its MAHA Fluid Power Research Centre, agreed to collaborate on a

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Agreement 1
2008 – 2011

research focused on the development of efficient and compact fluid power systems and components, with particular attention to the development of the following areas:

1. Efficiency increasing of multiple actuations systems;
2. Conceptual design of new circuital architectures for mobile machineries;
3. Design and development of energy saving hydraulic component;
4. Development of innovative experimental methodologies;
5. Development of advanced multidimensional CAD/CAE design tools.

Appointed as Co-Coordinator for the purpose of the agreement, the cooperation with Prof. Monika Ivantysynova is intended to:

- to develop joint and cooperative researches,
- to exchange academic staff members,
- to host exchange students, both undergraduate and postgraduate,
- to organize courses, seminars, workshops and scientific meetings.

International
Cooperation
Agreement 2
2008 – 2011

In October 2008 the University of Modena and Reggio Emilia, through its Department for Engineering Sciences and Methods, and the Johann Kepler University in Linz, through its Institute of Machine Design and Hydraulic Drives, agreed to collaborate on a research focused on the development of efficient and compact fluid power systems and components, with particular attention to the development of the following areas:

1. Mechatronics design of fluid power systems;
2. Mechatronics design of automotive handling systems;
3. Mechatronics design of off-road vehicles and machineries;
4. Design and development of hydro-Mechatronics component;
5. Development of innovative experimental methodologies;
6. Development of advanced multidimensional CAD/CAE design tools.

Appointed as Co-Coordinator for the purpose of the agreement, the cooperation with Prof. Rudolf Scheidl is intended to:

- to develop joint and cooperative researches,
- to exchange academic staff members,
- to host exchange students, both undergraduate and postgraduate,
- to organize courses, seminars, workshops and scientific meetings.

International
Cooperation
Agreement 3
2009 – 2012

In January 2009 the University of Modena and Reggio Emilia, through its Department for Engineering Sciences and Methods, and the Lappeenranta University of Technology, through its Department of LUT MECHANICAL, Laboratory of Mechatronics, agreed to collaborate on a research focused on the development of efficient and compact fluid power systems and components, with particular attention to the development of the following areas:

1. Mechatronics design of fluid power systems;
2. Mechatronics design of automotive handling systems;
3. Mechatronics design of off-road vehicles and machineries;
4. Design and development of hydro-Mechatronics component;
5. Development of innovative experimental methodologies;
6. Development of advanced multidimensional CAD/CAE design tools.

Appointed as Co-Coordinator for the purpose of the agreement, the cooperation with Prof. Heikki Handroos is intended to:

- to develop joint and cooperative researches,
- to exchange academic staff members,

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**International
Cooperation
Agreement 4
2009 – 2011**

- to host exchange students, both undergraduate and postgraduate,
- to organize courses, seminars, workshops and scientific meetings.

In April 2009 the University of Modena and Reggio Emilia, through its Department for Engineering Sciences and Methods, and the LMS NV in Leuven (B), an engineering innovation partner for companies in advanced manufacturing industries such as automotive, aerospace and other electro-mechanical industries, agreed to collaborate in the scope of the provision of training activities in Italy. In particular, the Hydraulic System Design Research Lab has been selected as reference educational structure for the delivery in Italy of basic training courses in the use of LMS Imagine.Lab AMESim CAE tool.

Technology Transfer

**Hydraulic
Valves
Design**

The CAE design of proportional and on/off control valves has been the first, and the most important, field of interest for the direct transfer to industry of numerical and experimental methodologies coming from theoretical and applied researches, and of numerical tools subsequently developed and tailored. Both on/off and proportional components have been considered, with a prevalence of spool solutions with respect to seat ones, and of slice architectures with respect to body and cartridge valves. Among other, a good expertise has been developed in the design of electro-hydraulic proportional directional control valves for mobile applications, in particular for load sensing valves, as well depicted by the cooperation agreements signed with HYDROCONTROL S.p.A. (2005, 40 k€), N.E.M. S.p.A. (2004, 15 k€), BUCHER HYDRAULICS S.p.A. (2008, 80 k€) and GALTECH S.p.A. (2009, 50 k€). At the same time, part of the activity has been spent in the field of valves for industrial application, like on/off directional valves (ARON S.p.A., 2003, 15 k€), or anti-shock anti-cavitation valves (HYDROCONTROL S.p.A., 2002, 25 k€).

**Volumetric
Machines**

The second field of interest for the cooperation with industries was the design and the development of volumetric machines, with particular attention devoted to the use of lumped and distributed parameter models to increase the performance of variable displacement units. More in details, a first field of application has been the performance improvement of variable displacement bent axis motors, (SAMHYDRAULIC S.p.A., 2005, 60 k€), both in terms of volumetric unit design optimization, and in terms of transient behaviour optimization of different displacement control systems (hydraulic, electro-hydraulic and load-sensing). Another research cooperation involved the re-design of a variable displacement swash plate axial piston pump (BREVINI FLUID POWER S.p.A., 2007), which design has been improved in order to allow both the direct control and the automatic balancing of the swash plate inclination. Finally, the numerical methodology has been applied also to the design of innovative linear actuators (FIMMA S.r.l., 2005, 20 k€), and the dynamic performance of a directly driven two effects telescopic cylinder has been obtained.

**Mobile
Application**

The third field of application of numerical methodologies regarded the numerical prediction of the dynamic behaviour of complex hydraulic systems, with both lumped and distributed parameter approaches. Examples of industrial cooperation in this field are the researches developed with HYDROCONTROL

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S.p.A. (2003, 25 k€) and WALVOIL S.p.A. (2003, 10 k€) for the analysis of the dynamic performance of mini-excavators load-sensing hydraulic circuits. Or, alternatively, the work supported by VALPADANA S.r.l. (2006, 30 k€) for the design of the forward-reverse motion control hydraulic system of a low-power agricultural tractor, or the one promoted by LANDINI S.p.A. (2008) for the analysis of the on field behaviour of different hydraulic suspension systems for mid-power agricultural tractors. Finally, a very intense research cooperation is under development with DANA TECHNOLOGIES S.p.A. for the analysis and the design of power transmissions for agricultural and off-highway applications.

**Industrial
Applications**

In the field of industrial application of fluid power, a special mention has to be addressed to the research cooperation activated with TETRAPACK S.p.A. (2006, 20 k€ - 2009 30 k€ - 2010, 80 k€) for the numerical analysis of the productive performance of hydraulic system for liquids automatic packaging. Using a mixed approach for numerical modelling, and combining mono-dimensional models to multi-dimensional ones, it was possible firstly to highlight the limit of application of standard circuit configuration, and then to propose some useful solutions to increase hydraulic system productivity (from 6000 pc/h to 10000 pc/h). Another industrial cooperation of absolute interest was the re-design of the hydraulic circuit and of the emulsion system of an automatic coffee machine, performed with PETRONCINI IMPIANTI S.p.A. (2006, 60 k€). After, the thermo-pneumatic behaviour of coffee roasting plants has been considered, to determine both the overall efficiency of the work-cycle, and the influence of process improvements (like regenerative recirculation, post-combustion or pre-mixing) on plants performance. In 2008 PETRONCINI IMPIANTI S.p.A. signed an agreement (250 k€) with the University of Modena and Reggio Emilia for the activation of a tenured position of research assistant in the field of Energy Systems.

**Automotive
Applications**

In the field of automotive application of fluid power, the technology transfer to industry followed two main branches. The branch dedicated to direct injection system for internal combustion engines founded a first important task in the research cooperation with LANDI RENZO S.p.A. (2005, 50 k€ - 2006, 50 k€) for the development of injectors and pressure regulators (both single and multiple stages) for CNG applications. Again, with reference to a four stroke, four cylinder engine of interest for MAGNETI MARELLI POWERTRAIN S.p.A., both the influence on engine performance of gasoline/ethanol blends has been evidenced (2007, 30 k€), and the design of a fast transient innovative CNG injection system has been performed (2008, 30 k€). The second line of activity, currently activated with FERRARI S.p.A. (2008, 20 k€ - 2009, 20 k€ - 2010, 50 k€), has been devoted to the performance determination and to the design improvement of the hydraulic circuits controlling the automotive “secondary” devices, like suspensions, gearbox, clutches, brakes, transmissions, ...

CAE Tools

The last technical aspect covered in the field of technology transfer is referred to the cooperation agreement signed to develop, to improve and to disseminate numerical tools useful for the CAE design of fluid power systems and components. The first example is represented by the grants activated in 2008 with BUCHER HYDRAULICS S.p.A. (20 k€) and with TECNORD S.r.l. (15 k€) for the introduction of open-source codes in their industrial design path. Another example is the cooperation agreement (currently under definition, approx. 40 k€) with LMS Imagine Lab AMESim, for the inclusion into the



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Hydraulic Component Design Library of a special library dedicated to multiple notched metering edges design.