

Barbara Zardin
Assistant Professor in Fluid Power at the Engineering Department Enzo Ferrari,
University of Modena and Reggio Emilia.
Fluid power Lab,
Engineering Department "Enzo Ferrari"
Strada Vignolese 905, 41125, Modena, Italy
Ph: +39 059 205 6341
Fax: +39 059 205 6126
e-mail: barbara.zardin@unimore.it

Born on May 12th 1978 in Legnago (Verona), Italy
Assistant Professor in Fluid Power at the Engineering Department Enzo Ferrari since December 2010.

EDUCATION

Doctor of Philosophy in Mechanical Engineering ("Ingegneria delle Macchine e Sistemi Energetici") at the University Of Bologna, June 2008

Thesis: "Modellizzazione Numerica e Caratterizzazione Sperimentale di Macchine e Componenti Oleodinamici", (Numerical Modelling and Experimental Characterization of Hydraulic Components), Advisor Prof. Ing. Massimo Borghi.

Master of Science in Mechanical Engineering at the University of Modena and Reggio Emilia, October 2003.

Area: Fluid Power, thesis concerning numerical modelling of the behaviour of external gear pumps and motors.

RESEARCH

Research activity has concerned fluid power components and systems for both industrial and mobile applications.

Fluid power systems:

-Study of the translation of mini-excavator and road roller vehicles: modelling and simulation of the hydraulic circuits, study and optimization of braking and speed up phases, study of the variable displacement mechanism which enables to change the vehicle speed.

-Study of the energy dissipation of the auxiliary utilities hydraulic circuit in agricultural tractors: this is a typical load sensing multi actuator application, to overcome the limits of this kind of circuit an alternative architecture based on independent metering concept and electrically controlled proportional valves and variable displacement pump is under study. A preliminary evaluation has allowed to estimate that a considerable percentage of energy can be saved with the alternative configuration; dynamic behaviour of the proportional valves and of the variable displacement pump are now under study.

Fluid Power components:

-Study of the lubricating gaps of external gear machines and axial piston swashplate machines: this aspect is of vital importance for the evaluation of mechanical and volumetric efficiencies, for the optimization and improvement of machine behaviour and in order to raise the power to weight ratio of the machine. Optimal efficiency means lower energy consumption and this aspect is fundamental especially in mobile applications. The research has been conducted developing and using home-made numerical codes which allow to solve Reynolds equation inside the lubricating gaps; a numerical procedure able to find both the pressure distribution and the gaps geometry during machine operation has been developed. The influence of operating and design parameters has been studied enabling to use the code in order to improve the design process of the machines studied.

-Study of the dynamic behaviour of external gears and axial piston swashplate machines: lumped parameter models of these kind of machines has been developed using a commercial software (LMS Imagine.Lab AMESim) pressure transients within the machine chambers, instantaneous flow and torque are the output of these models which enables to study the influence of the main operating and geometric parameters on the machine behaviour. The topics of pressure peaks and cavitation within the volume chambers, influence of the valve plate (axial piston machine) or of the bearing blocks geometry (external gear machine) have been addressed.

-Modelling and experimental characterization of load sensing proportional distributors: study of the metering characteristics through lumped parameter models, energy dissipation evaluation, experimental characterization at the test rig.

The research activities have been conducted using both commercial and home-made software in Matlab, Fortran and C language. Moreover, when possible, also experimental characterization of hydraulic pumps, motors and proportional valves has been realized using hydraulic test rigs and data acquisition devices with Labview software interfaces.

SELECTED TECHNICAL PAPERS OF THE LAST 5 years

- [1] Borghi M., Specchia E., Zardin B., 2009, "Numerical Analysis of the Dynamic Behaviour of Axial Piston Pumps and Motors Slipper Bearings", SAE International Journal of Passenger Cars-Mechanical Systems Vol 2 (1), pp. 1285 – 1302. ISSN 1946-3995.
- [2] Borghi M., Milani M., Paltrinieri F., Zardin B., 2006, "Numerical Characterization of Pipes and Hoses Dynamic Response", 2nd International Conference on Computational Methods in Fluid Power, FPNI'06 – August 2-3, Aalborg, Denmark.
- [3] Borghi M., Milani M., Paltrinieri F., Zardin B., 2006, "The influence of aeration and cavitation on gear pumps and motors meshing volumes pressures", Paper Number IMECE2006-13735, International Mechanical Engineering Congress and Exposition 2006, November 5-10, Chicago, Illinois US. ISBN 0-7918-3790-4.
- [4] Borghi M., Milani M., Paltrinieri F., Zardin B., 2008, "External Gear Pumps and Motors Bearing Blocks Design: Influence on the Volumetric Efficiency", Technical Paper Number NCFP I08-21.1, Proceedings of the 51st National Conference on Fluid Power, IFPE 2008, Las Vegas, Nevada.
- [5] Borghi M., Zardin B., 2008, "Modelling and Simulation of External Gear Pumps and Motors", Proceedings of the 5th Ph.D. FPNI Symposium, Krakow, Poland, Award: "Most Outstanding Contribution Award".
- [6] Borghi M., Specchia E., Zardin B., Corradini, E., 2009, "The Critical Speed in Axial Piston Swash Plate Type Pumps and Motors", Paper Number DSCC2009-2604, Proceedings of the 2009 ASME Dynamic Systems and Control Conference & Bath/ASME Symposium on Fluid Power & Motion Control (DSCC2009), Hollywood, California, US. ISBN 978-0-7918-3860-0
- [7] Borghi M., Zardin B., Specchia, E., 2009, "External Gear Pump Volumetric Efficiency: Numerical and Experimental Analysis", SAE Paper Number 2009-01-2844, SAE Commercial Vehicle Congress and Exposition, October 6 -8, Rosemont, Illinois, US..
- [8] Borghi, M., Zardin, B., Mancarella, F., Specchia, E., 2010, "Energy Consumption of the Hydraulic Circuit of a Mid-Size Power Tractor", 7th IFK Fluid Power Conference, 22-24 March 2010, Aachen, Germany.
- [9] Borghi, M., Mancarella, F., Zardin, B., 2010, "Energy dissipation of the hydraulic circuit of remote auxiliary utilities of an agricultural tractor" FPMC Fluid Power and Motion Control 2010, 15-17 September 2010, Bath, England.
- [10] B. Zardin, 2008, "Modellizzazione Numerica e Caratterizzazione Sperimentale di Macchine e Componenti Oleodinamici", (Numerical Modelling and Experimental Characterization of Hydraulic Components), Ph.D. thesis in "Ingegneria delle Macchine e dei Sistemi Energetici", XX ciclo, S.S.D. ING-IND/08, Università di Bologna.
- [11] M. Borghi M., B. Zardin, E. Specchia, F. Pintore, E. Corradini Displacement Control in Variable Displacement Axial Piston Swashplate Type Pumps, Proceedings of the "The Twelfth Scandinavian International Conference on Fluid Power", SICFP'11, ISBN 9789521525209.
- [12] F. Pintore, B. Zardin, M. Borghi, Fluid power supply unit for agricultural tractors: towards energy saving through simulation, Proceedings of "7th International FPNI PhD Symposium on Fluid Power" ISBN 9788875590697.
- [13] A. Benevelli, B. Zardin, M. Borghi, Independent metering architectures for agricultural tractors auxiliary utilities., Proceedings of "7th International FPNI PhD Symposium on Fluid Power" ISBN 9788875590697.