Centro Interdipartimentale
per la Ricerca Applicata e i Servizi
nel Settore della Meccanica Avanzata e della Motoristica

InterMech Mo.Re.

Unità Operativa di Ricerca 1.1
AUREUM
Laboratorio di Idraulica del Veicolo

LAB. IDRAULICA DEL VEICOLO

Team Leader

Prof. Ing. Massimo Borghi

Team

Ing. Barbara Zardin

Ing. Francesco Pintore,

Ing. Emiliano Specchia,

Ing. Alessandro Benevelli.

AGENDA

- Team
- Off-Road Vehicles: Energy Saving, Fuel Economy, Performances, Safety, Comfort
  - Hydraulic Systems

  →alternative circuit architectures

  →electronic control integration
  - Hydraulic Components

  →pumps and motors efficiency

  →variable displacement pumps

TEAM

Barbara Zardin

2010 - Ricercatore a tempo indeterminato presso il Dipartimento di Ingegneria Meccanica e Civile di Modena, Laboratorio di idraulica del Veicolo

2008 - Dottorato in Ingegneria delle Macchine e dei Sistemi Energetici, Università di Bologna

2003 - Laurea in Ingegneria Meccanica presso l'Università degli Studi di Modena

Francesco Pintore

2010 - Laurea in Ingegneria Meccanica presso Università degli Studi di Modena;

2011- Dottorando di Ricerca presso Scuola di Dottorato "High Mechanics and Automotive Design & Technology", indirizzo "Meccanica avanzata e tecniche del veicolo".

Alessandro Benevelli

2010 - Laurea in Ingegneria Meccanica presso Università degli Studi di Modena

2011 - Assegno di ricerca presso Centro Interdipartimentale INTERMECH-MORE dell'Università degli Studi di Modena e Reggio Emilia "*Generazione e validazione sperimentale di modelli di componenti e di sistemi idraulici a basso consumo energetico per impiego veicolistico".*

Emiliano Specchia

2008 - Laurea in Ingegneria Meccanica presso Università degli Studi di Modena

2009 - Dottorando Iscritto alla *Scuola di Dottorato "High Mechanics and Automotive Design & Technology", Metodi di Simulazione e Progettazione Meccanica*

Energy Saving in Mobile Hydraulics
→alternative architectures vs. hydraulic load sensing

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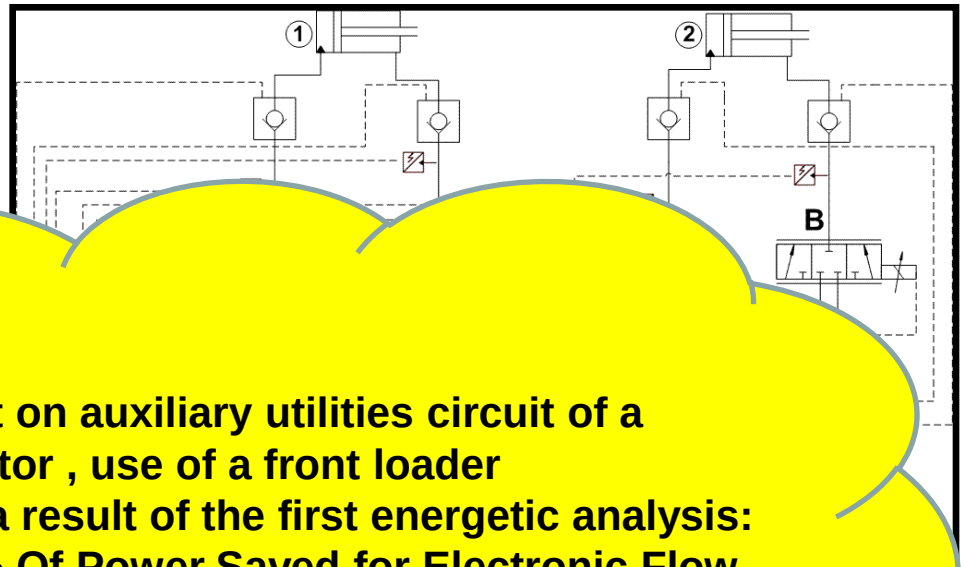

Alternative architecture for l
energy dis
electro
indep
f
→
→ind
management
→management of overruning loads

Test on auxiliary utilities circuit of a tractor , use of a front loader
As a result of the first energetic analysis:
36% Of Power Saved for Electronic Flow Matching Independent Metering Arch.
25% Of Power Saved for Electronic Load Sensing Independent Metering Arch.

pump
the valves
es and pump (damping, delay,

Partners: CRF-CNH-EATON-CARER

Energy Saving in Mobile Hydraulics
→alternative architectures vs. hydraulic load sensing

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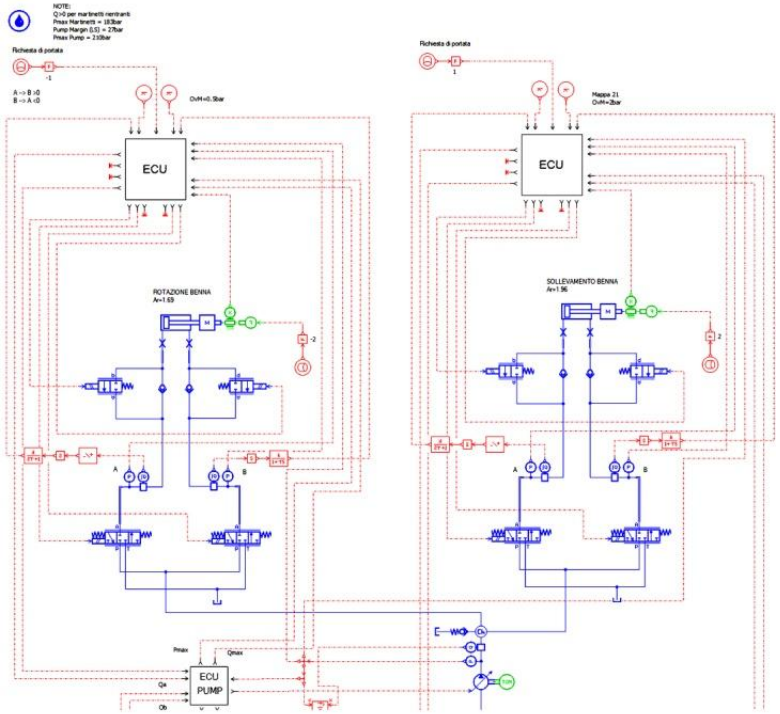
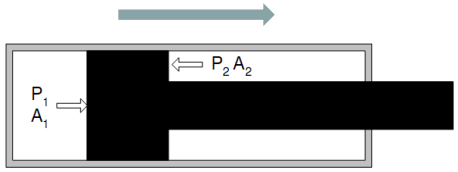
ECU Strategy Evolution

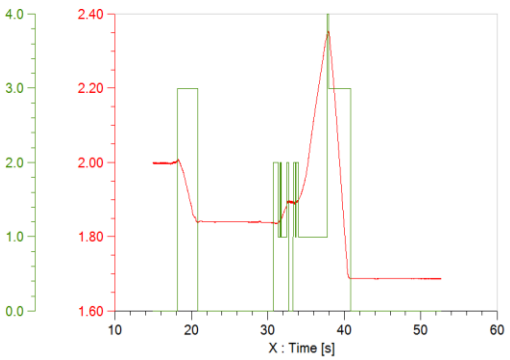


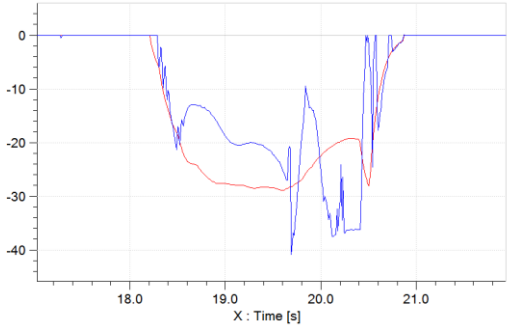
Closed-loop pressure and flow rate control

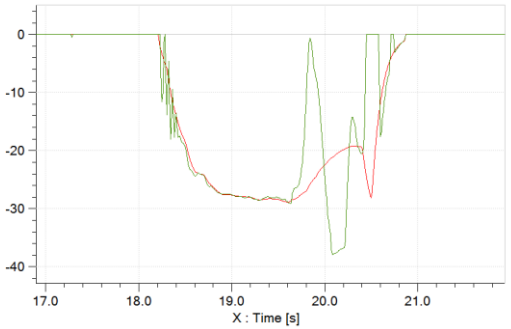


$$P2 \cdot \frac{A2}{A1} - P1 > K \rightarrow Overrunning$$

$$P2 \cdot \frac{A2}{A1} - P1 < K \rightarrow Passive$$







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Energy Saving in Mobile Hydraulics
→alternative architectures vs. hydraulic load sensing

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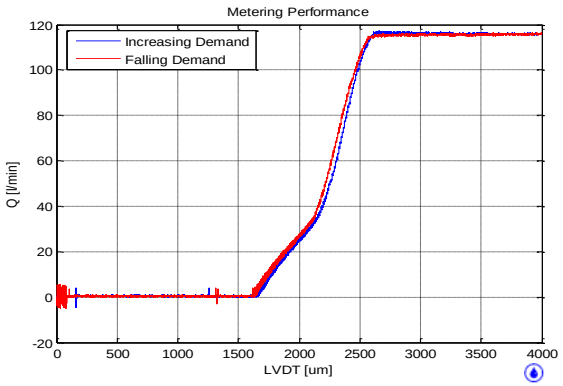
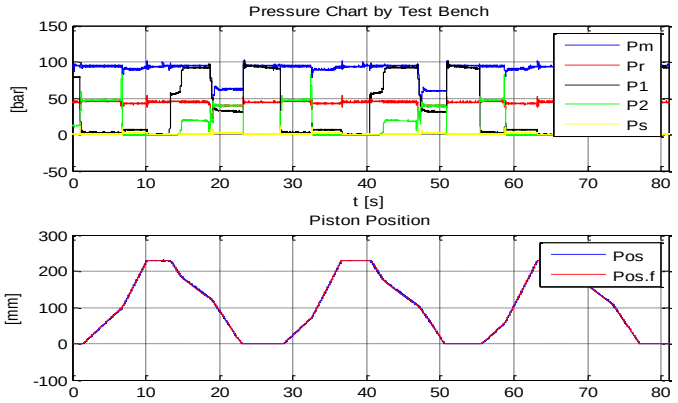
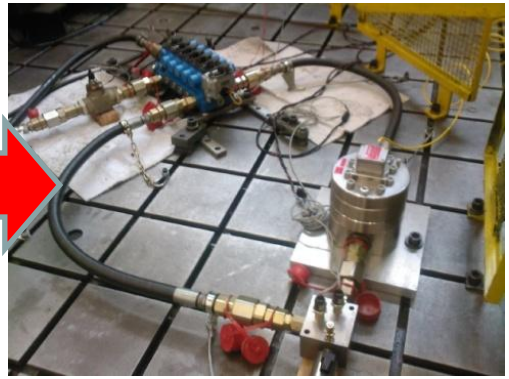
Commercial IM Valve

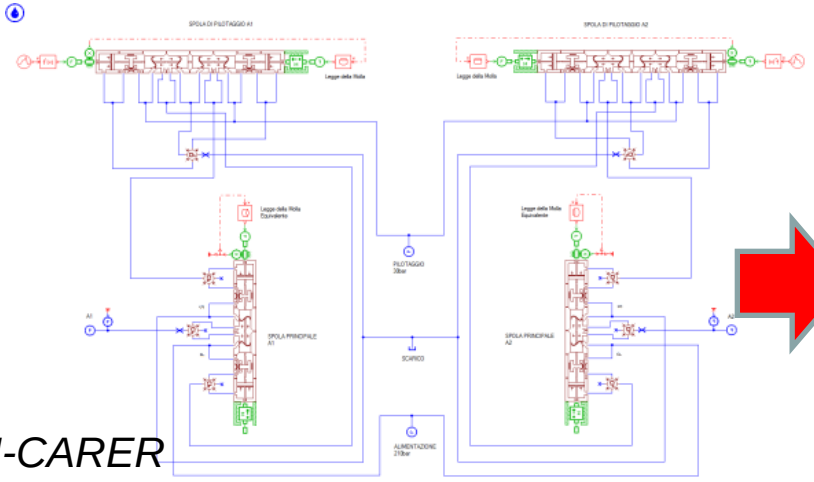
Test of the IM valve

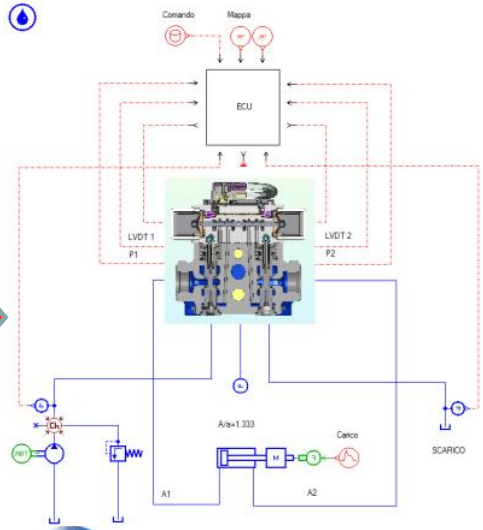






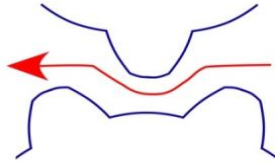
Modelling of the IM valve
and integration
in the global architecture





Partners: CRF-CNH-EATON-CARER

Energy Saving in Mobile Hydraulics
→Pumps/Motors Efficiency



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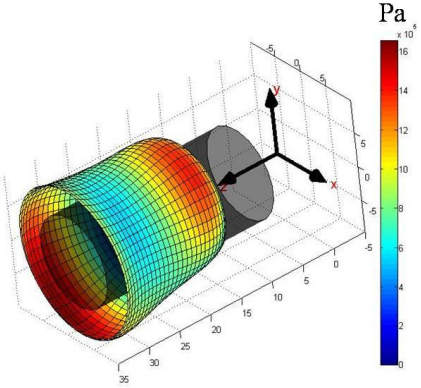
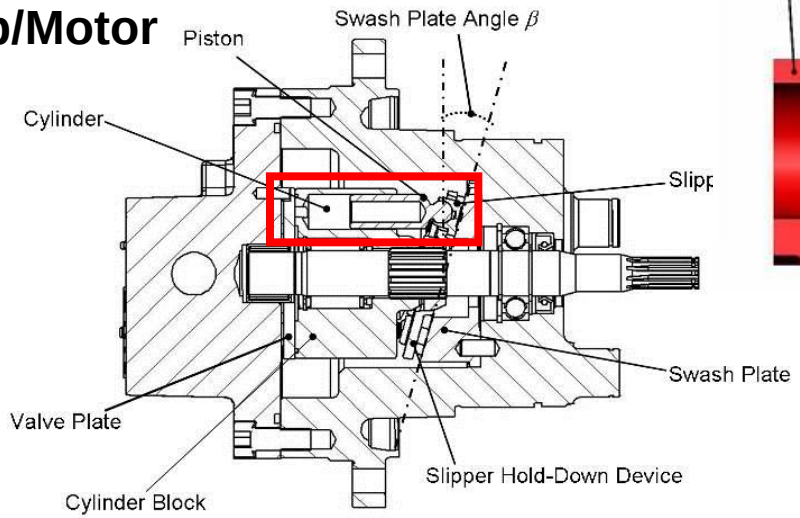
Analysis of the Lubrication Mechanism within the Gaps

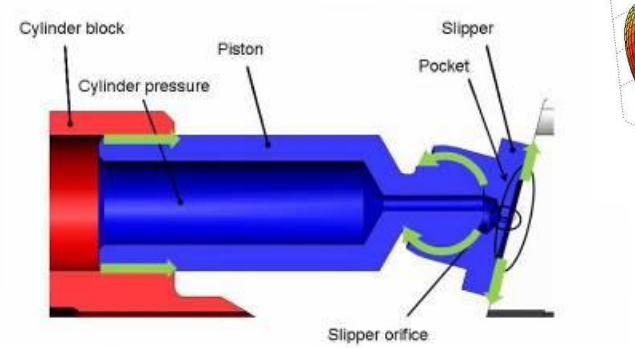
→to determine <u>volumetric and mechanical efficiency</u>

→<u>to have a design tool for the optimization of efficiency</u>



Axial Piston Swashplate Pump/Motor





Numerical procedure to determine the gaps height, tilt and the pressure distribution in the gap → viscous forces, and leakages

Partners: POCLAIN

Energy Saving in Mobile Hydraulics
→ Variable Displacement Pumps

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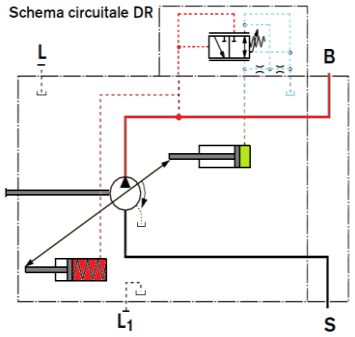
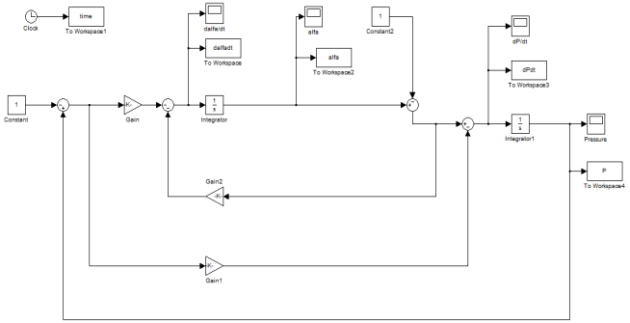
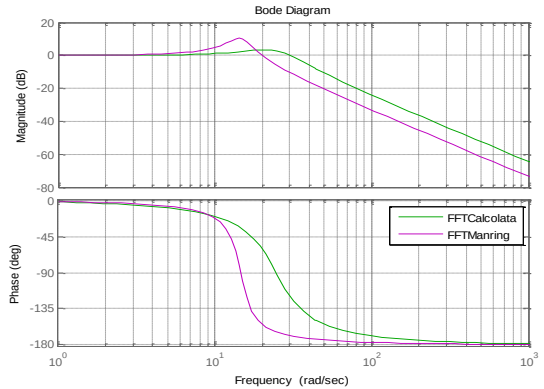
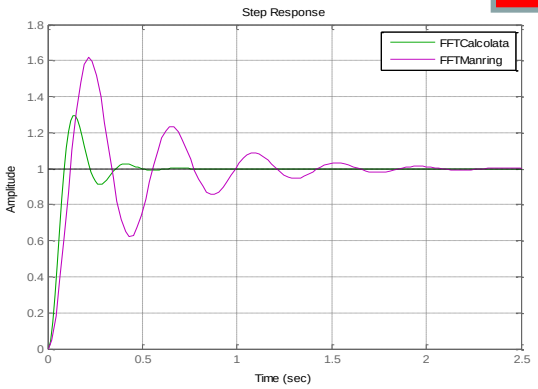
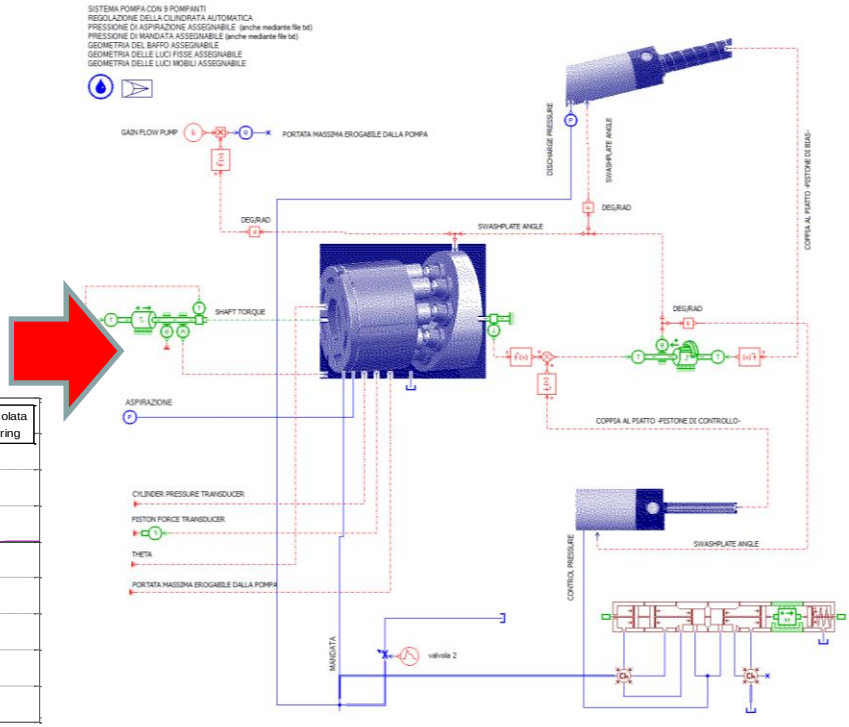
Variable Displacement with Pressure Compensator











Partners: CRF-CNH-EATON-CARER-POCLAIN