IEEE VPPC 2010
Vehicle Power and Propulsion Conference
September 1-3, 2010 — Lille, France
Clean Tech for Transportation
http://www.vppc2010.org/






Special session

" ENERGETIC MACROSCOPIC REPRESENTATION AND OTHER GRAPHICAL DESCRIPTIONS "

organized by

MEGEVH

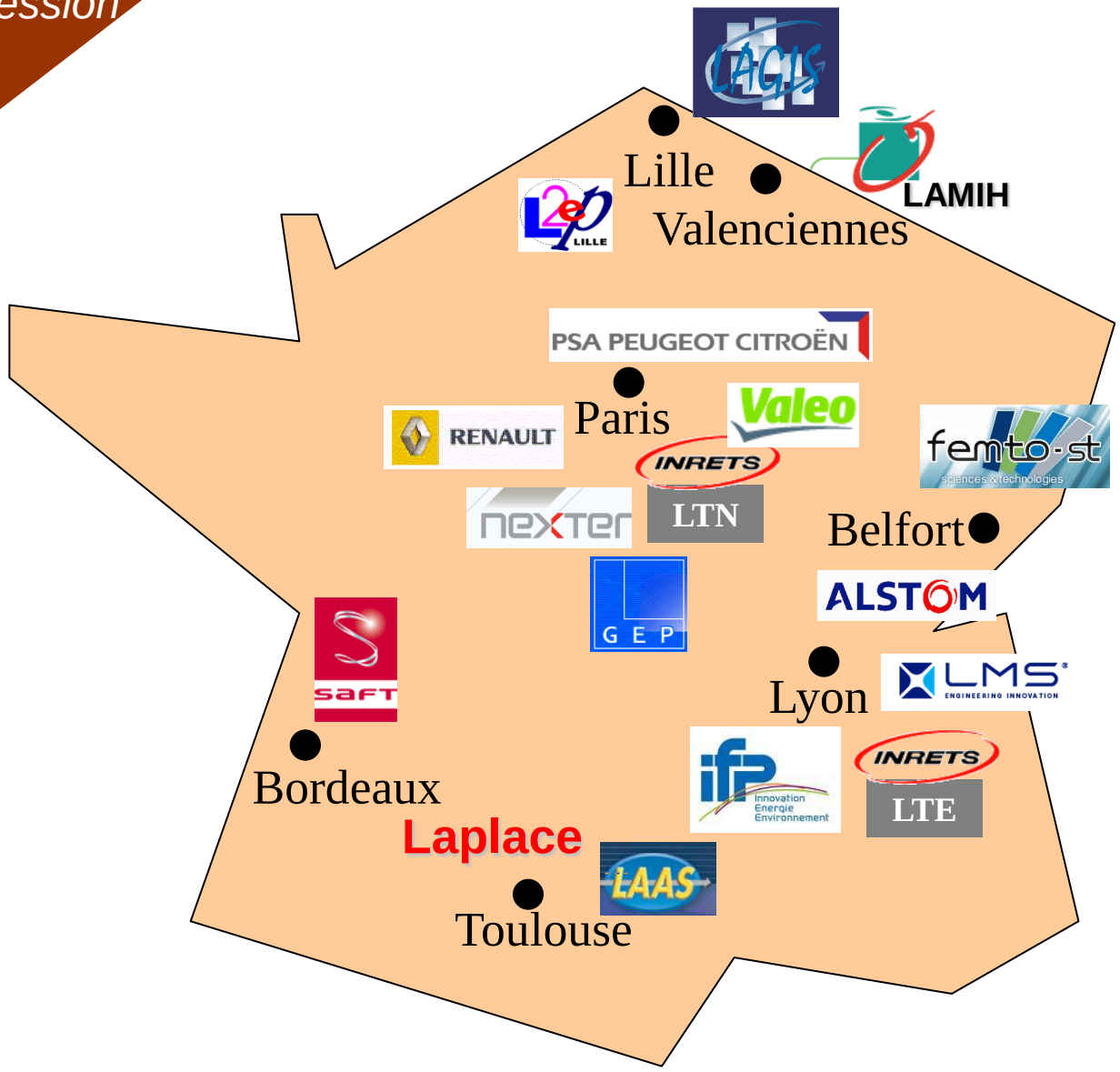
(French network on Hybrid Electric Vehicle's)

Session chairs:

Dr. Keyu CHEN (University of Lille, France)

Prof. Pierre SICARD, (Université du Québec à Trois-Rivières, Canada)

MEGEVH partners

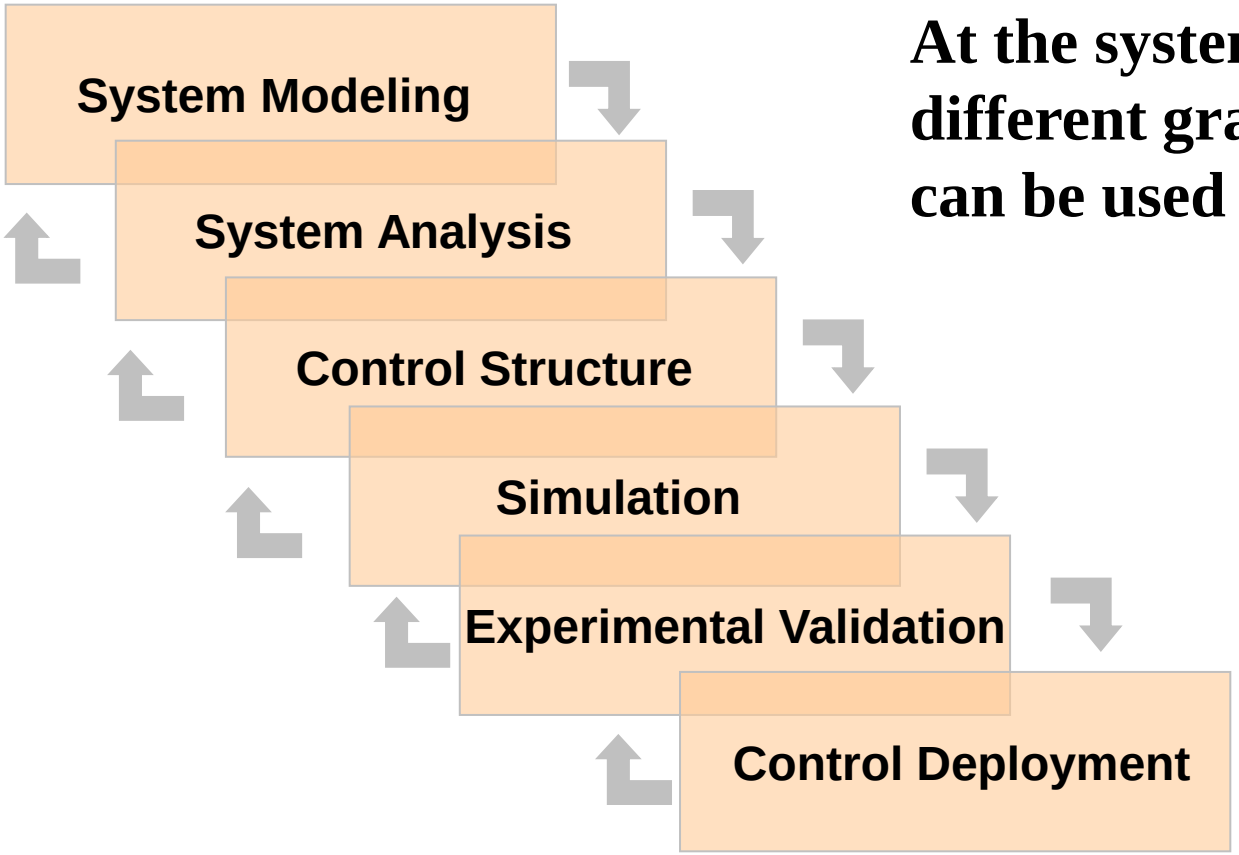


Objective:
to promote collaborative works on HEV in the French community

Energetic Macroscopic Representation (EMR)

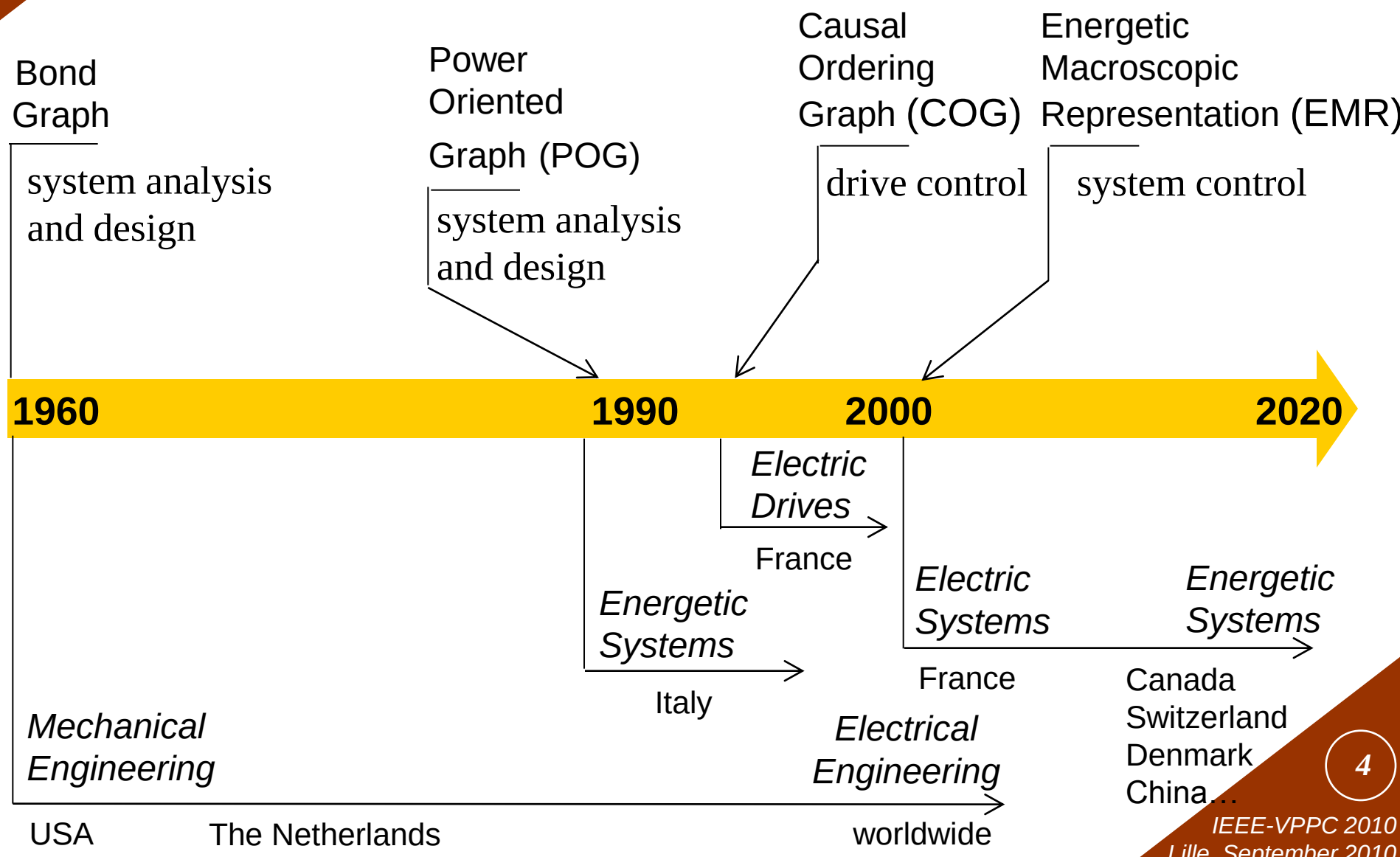
http:///l2ep.univ-lille1.fr/megevh/

Model-based control design process



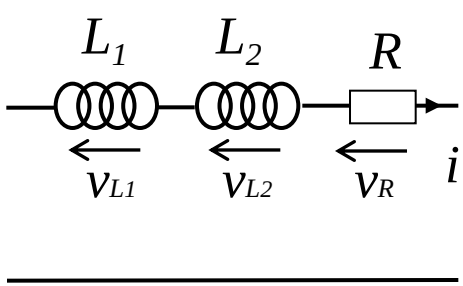
At the system modeling step, different graphical descriptions can be used to organize models.

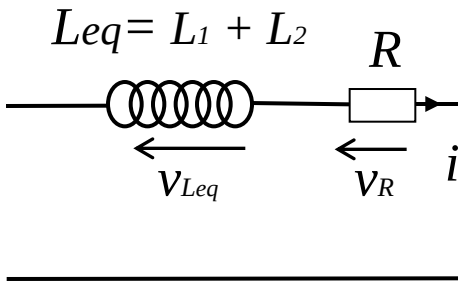
Different graphical descriptions



Different graphical descriptions

- Structural or functional descriptions





Structural descriptions

- Priority to the physical structure
- Physical links between subsystems
- Application to design

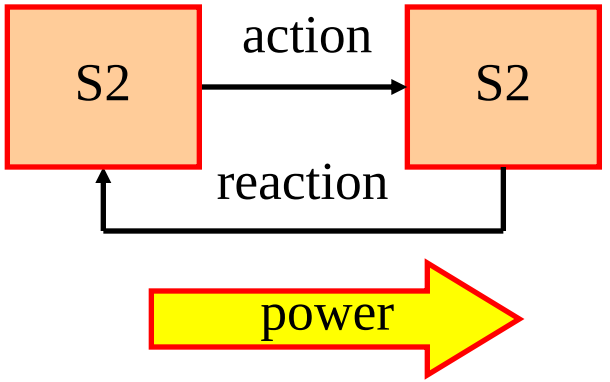
Functional descriptions

- Priority to the functionality
- Virtual links between subsystems
- Application to analysis, control

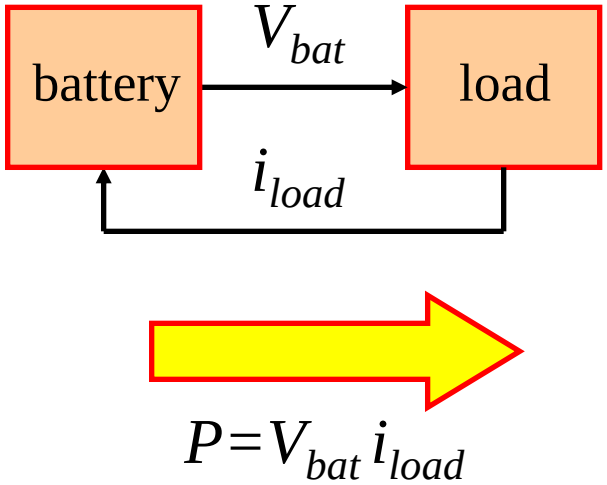
Different graphical descriptions

- Structure or functional descriptions

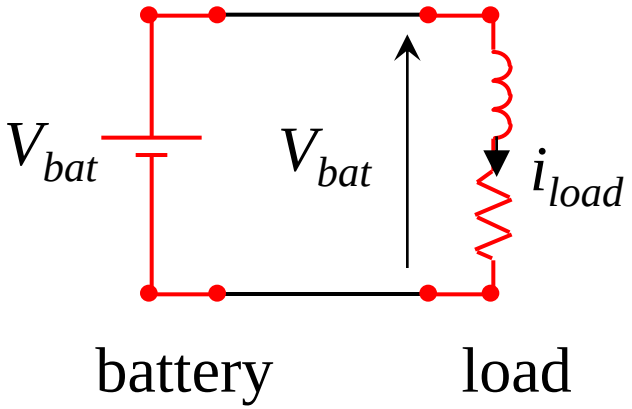
- Interaction principle for energy systems



Power exchanged by S1and S2 = action x reaction



Example

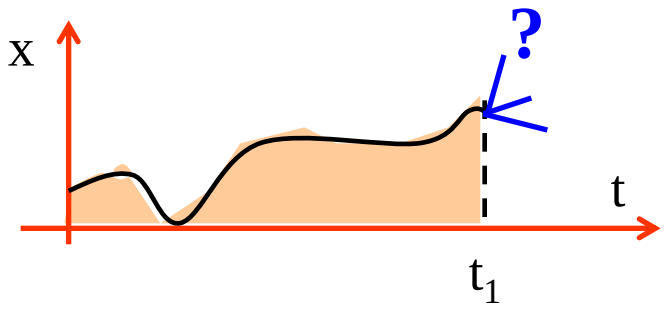


Different graphical descriptions

- **Structure or functional descriptions**

- **Interaction principle for energy systems**

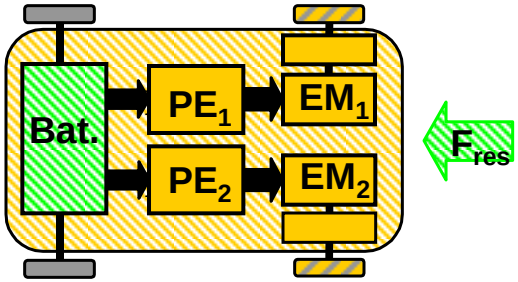
- **Causality**



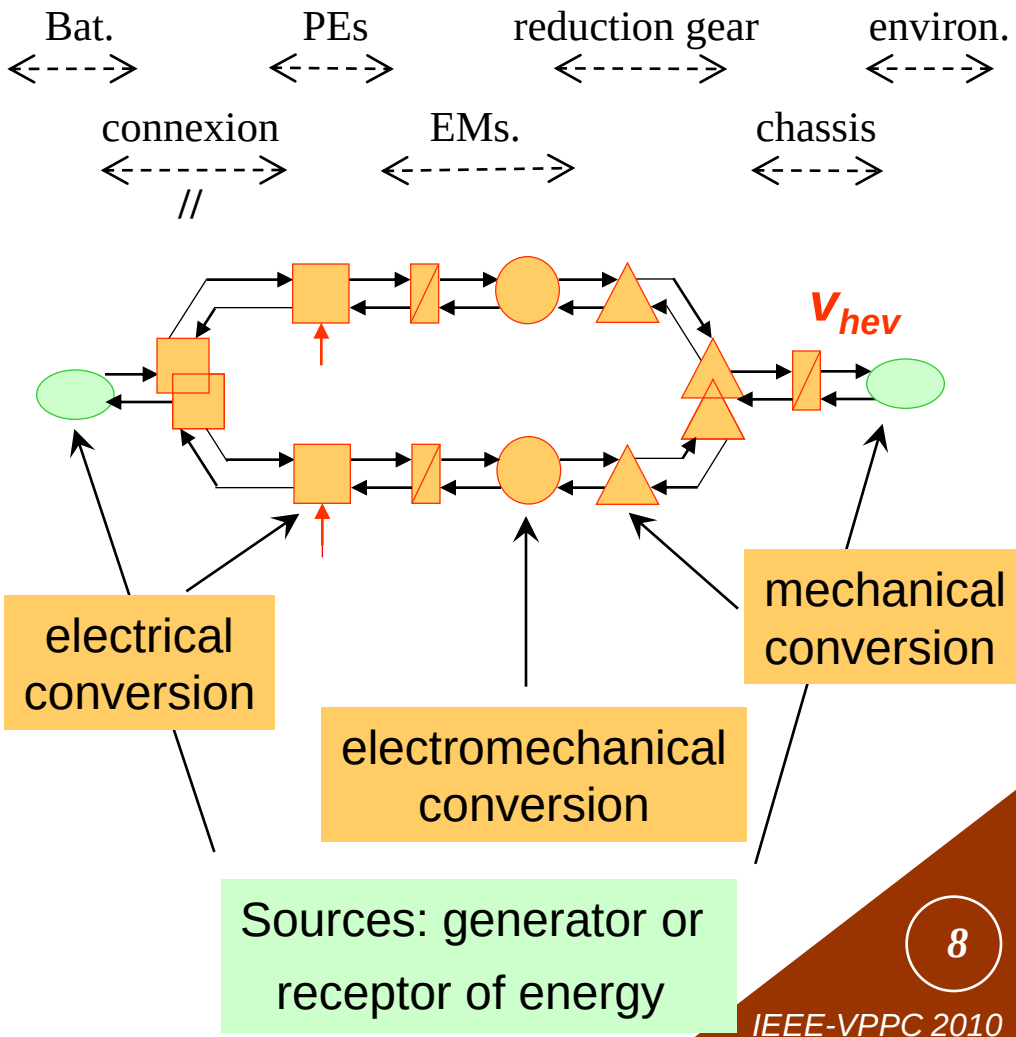
$\int x dt$ ⇨ surface ⇨ knowledge of past evolution **OK in real-time**

$\frac{dx}{dt}$ ⇨ slope ⇨ knowledge of future evolution **impossible in real-time**

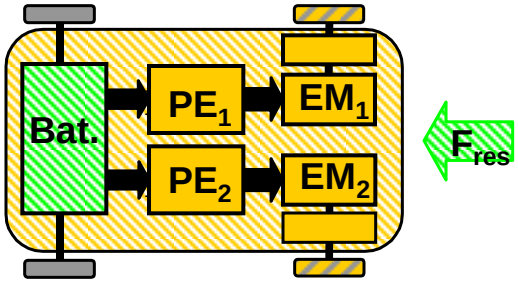
Energetic Macroscopic Representation (EMR)



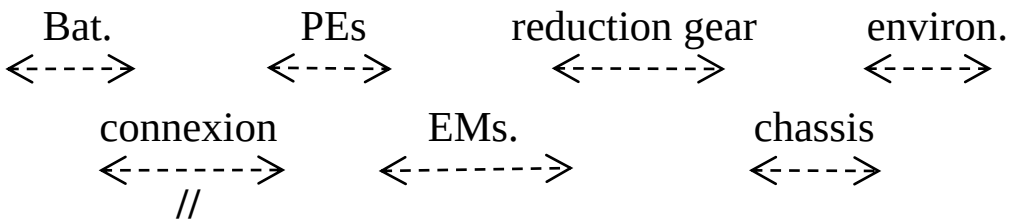
➢ **Functional Representation**

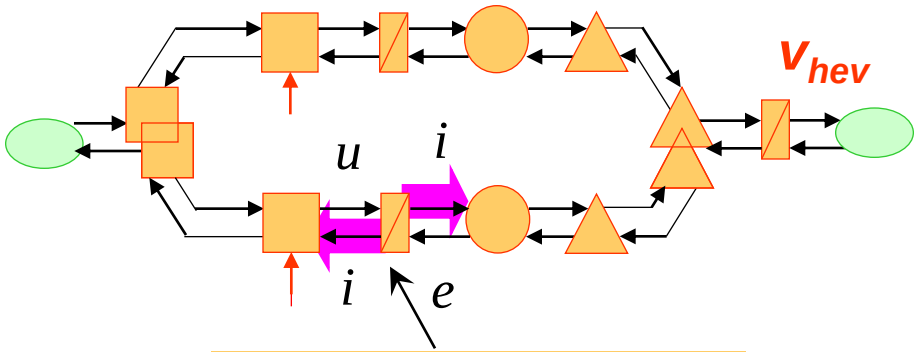


Energetic Macroscopic Representation (EMR)



- **Functional Representation**
- **Causal modeling**





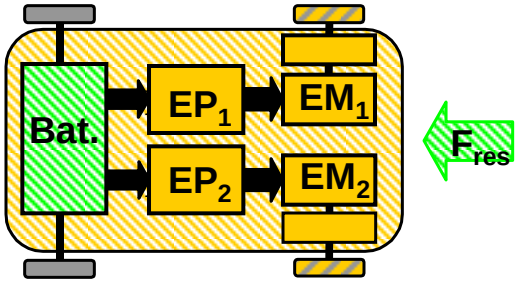
accumulation of energy

$$\text{output} = \int \text{input}$$

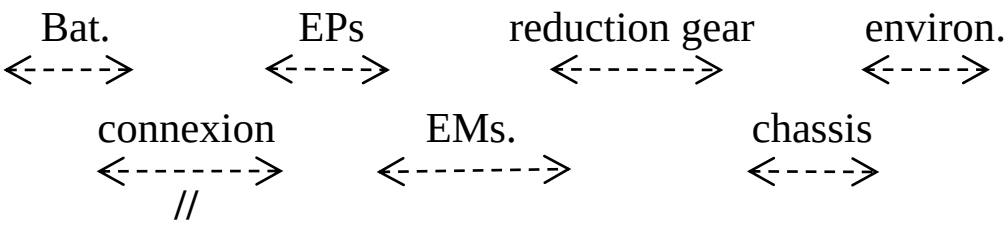
i state variable

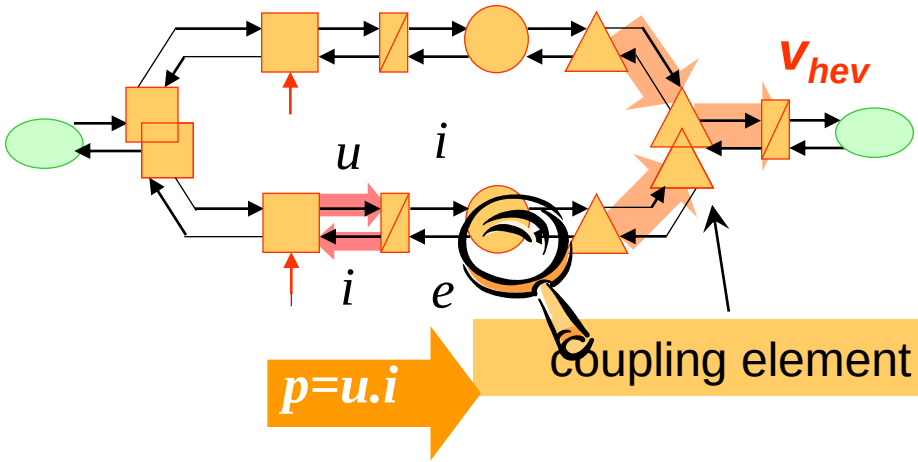
$$E = \frac{1}{2} L\, i^2$$

Energetic Macroscopic Representation (EMR)



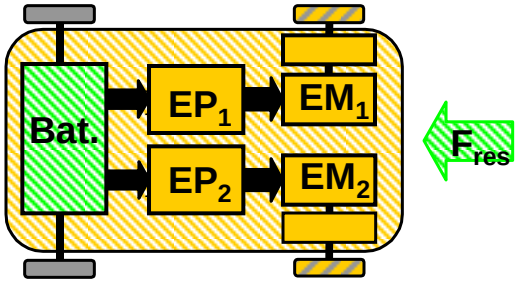
- **Functional Representation**
- **Causal modeling**
- **Global energetic view**
- **Energy distributions emphasized by coupling elements**

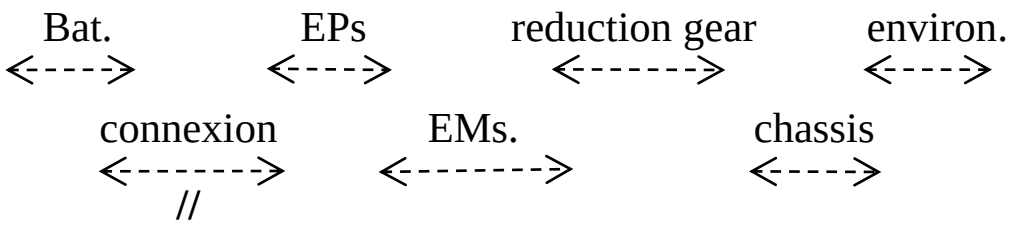




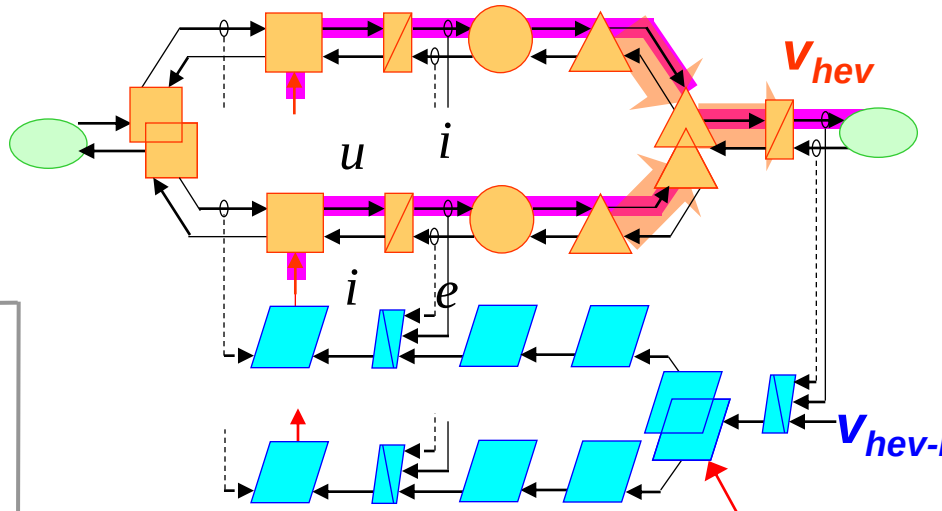
action / reaction principle

Energetic Macroscopic Representation (EMR)



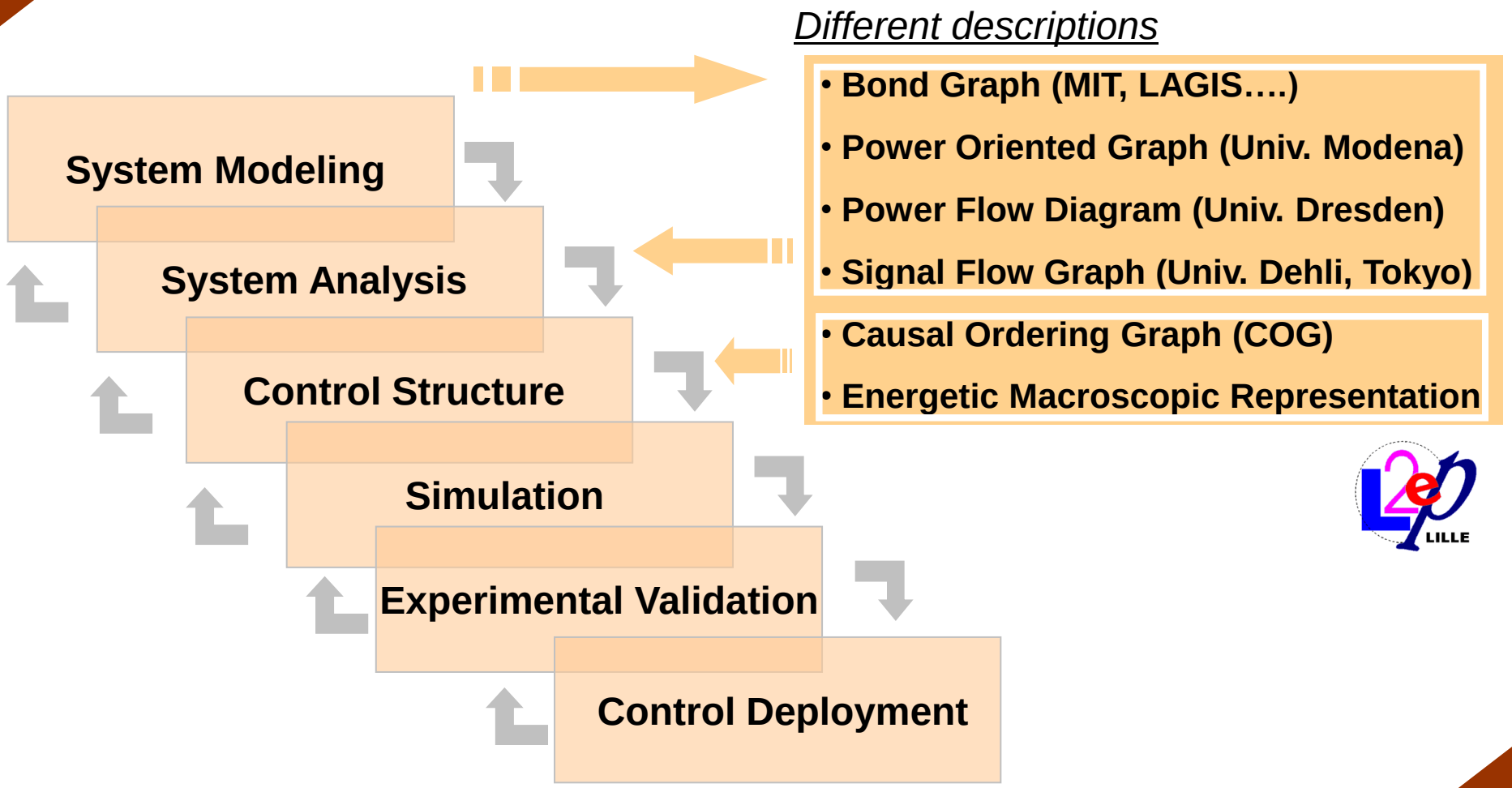


- **Functional Representation**
- **Causal modeling**
- **Global energetic view**
- **Energy distributions emphasized by coupling elements**

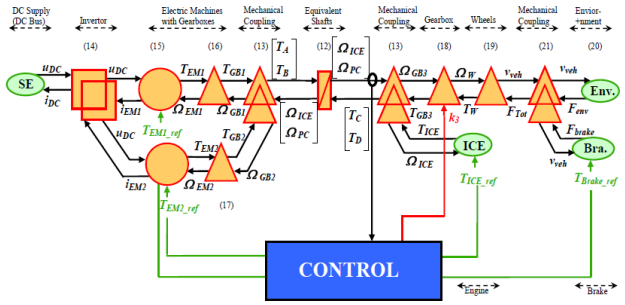


- **Inversion-based control**
- **Degrees of freedom emphasized by the inversion of coupling elements**

Model-based control design process



Oral Session Outline



1. **The Bond Graph - an excellent modelling tool to study abstraction level and structure comparison**

   G.-H. Geitner (Technical University Dresden, Germany)

2. **The Power-Oriented Graphs Technique: system modeling and basic properties**

   R. Zanasi (Univ. Modena and Reggio Emilia, Italy)

3. **An Energetic Based Method Leading to Merged Control Loops for the Stability of Input Filters**

   P. Barrade. & al. (EPF Lausanne, Switzerland)

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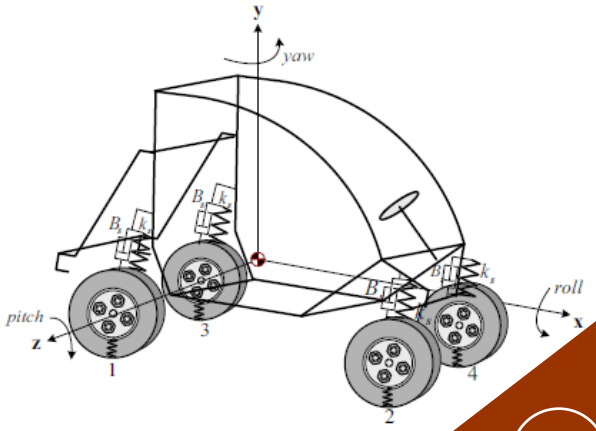
4. **Modelling of Power Split Device for Heavy-Duty Vehicles**

   S.A.Syed & al. (Univ. Lille, France, ***MEGEVH***)

5. **Practical Control Structure of a Heavy Duty Hybrid Electric Vehicle**

   J. Solano-Martínez & al. (Univ. Franche Comté & Army General Direction, France)



Dialogue Session Overview

Friday, September 3, 2010, 9h30-10h30

1. **Comparison between Forward and Backward approaches for the simulation of an Electric Vehicle,** M. Delavaux & al. (Univ. Lille, France)

2. **Control Strategy with Saturation Management of a Fuel Cell/Ultracapacitors Hybrid Vehicle,** T. AZIB& al. (LGEP, France)

3. **EMR and inversion-based control of a virtual reality bicycle trainer,** M.-A. LEBLANC & al. (Univ. Québec à Trois-Rivières, Canada)

4. **Energetic Macroscopic Representation and PSIM simulation: application to a DC/DC converter input filter stability,** P. Barrade & al. (EPF Lausanne, Switzerland)

Dialogue Session Overview

Friday, September 3, 2010, 9h30-10h30

5. **Energetic Macroscopic Representation of a Solid Oxide Fuel Cell for Stirling Engine combined cycle in High-efficient Powertrains,** C. Gay & al. (Univ. Franche-Comte, France)

6. **Modeling of Electric Vehicles Dynamics with Multi-Bond Graphs,** L. I. Silva & al (Universidad Nacional de Rio Cuarto, Argentina)

7. **Modelling, Simulation and Validation of an Electrical Zero Emission Off-Road Motorcycle,** T. Bäuml (AIT Austrian Institute of Technology, Austria)

8. **Energetic Macroscopic Representation and Maximum Control Structure of Electrical Vehicles Charging Photovoltaic System,** F. Locment & al (Univ. Technologie de Compiègne)