INTERNATIONAL SUMMER SCHOOL - EMR'13

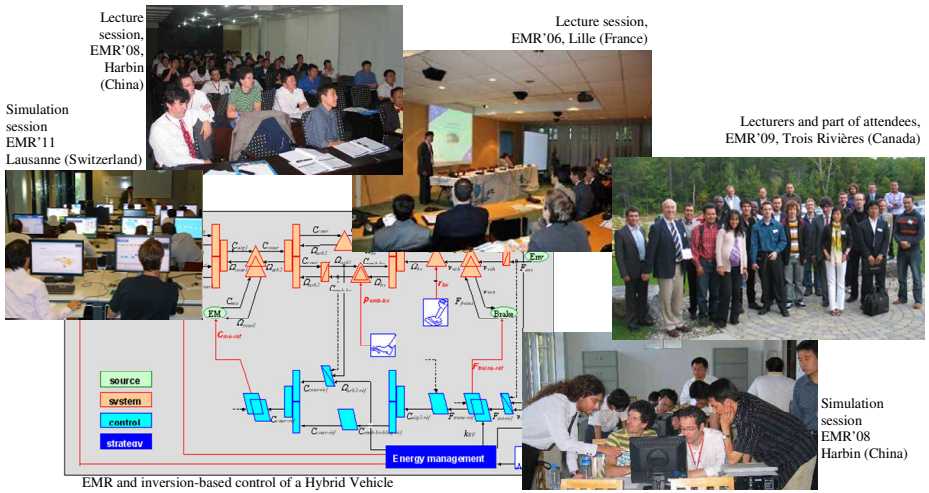
« Modelling and control using

Energetic Macroscopic Representation

Application to hybrid electric vehicles and others »

Université Lille1, France

9-11 September 2013



EMR and inversion-based control of a Hybrid Vehicle

Université Lille1 Sciences et Technologies

MEGEVH French network on HEVs

IEEE

EPE

L2EP LILLE

WORKSHOP ORGANIZATION

This workshop is a Summer School of Université Lille1 (France).

General chair

Dr. Walter LHOMME (Université Lille1, L2EP, MEGEVH, France)

Co-chair

Prof. Alain BOUSCAYROL (Université Lille1, L2EP, MEGEVH, France)

Scientific committee

Dr. Philippe BARRADE (Ecole Polytechnique Fédérale de Lausanne, LEI, Switzerland)
Dr. Loic BOULON (Université du Québec à Trois-Rivières, GRÉI, Canada)
Dr. Lucia GAUCHIA (University MacMaster, Canada)
Prof. Daniel HISSEL (University of Franche Comté, FEMTO-ST, MEGEVH, France)
Prof. Betty LEMAIRE-SEMAIL (Université Lille1, L2EP, France)
Prof. Pierre SICARD (Université du Québec à Trois-Rivières, GRÉI, Canada)
Dr. Rochdi TRIGUI (IFSTTAR, LTE, MEGEVH, France)

REGISTRATION

Due to the simulation training session, the number of attendees is limited to 50. A registration form is required. The registration fees include coffee breaks, lunches, the workshop booklet and the access to the pdf file and the EMR library.

Students:	70 €
Regular:	140 €
After July 15th:	200 €

INFORMATION

Contact: walter.lhomme@univ-lille1.fr

More information: http://www.emrwebsite.org/

EMR'06 - Lille (France), EMR'08 - Harbin (China), EMR'09 - Trois-Rivières (Canada), EMR'11 - Lausanne (Switzerland), EMR'12 - Madrid (Spain)

Workshop Objectives

This workshop is focused on the Energetic Macroscopic Representation (EMR) methodology for modelling and control of complex electromechanical systems.

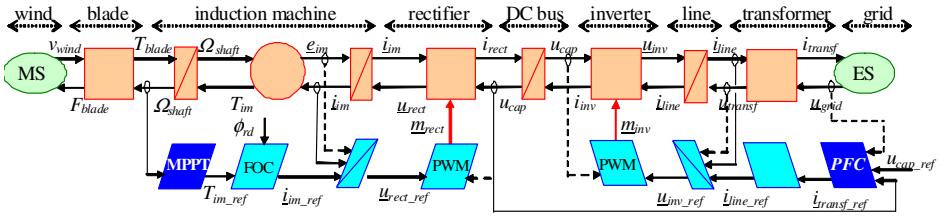
This Summer School is dedicated to Master and PhD students, Engineers and scientists, from both academia and industry, which have to model and control new electromechanical systems such as industrial multi-drive systems, traction and propulsion systems, hybrid electric vehicles, or renewable energy generation systems.

This year, the traditional summer school is linked to the Doctoral School of "Engineering Science" of the Lille1 University. The opportunity is given to the PhD students to follow this seminar (3 ECTS). They will take benefits from the practical exercises that will be proposed. They will have the possibility to use the EMR methodology on examples they will propose, solve and present.

EMR is a graphical modelling tool that was introduced in 2000 to describe complex electromechanical systems. EMR has since been extended to complex multiphysics systems (combining thermal science, electrochemistry, fluid mechanics …). EMR is based on the action-reaction principle to organize the interconnection of sub-systems according to the physical causality (i.e. integral). This description highlights energetic properties of the system (energy accumulation, conversion and distribution). Moreover, an inversion-based control can be systematically deduced from EMR using specific inversion rules.

Compared with other causal modelling tools such as Bond Graphs or Causal Ordering Graphs (COG), EMR has a more global energetic view and contributes to system's control design. It differs from non-causal modelling tools such as Physic Modelling Language (PML) using Object-Oriented Modelling Language, which makes its libraries to be coupled in the same way as physical units. EMR is focused on the system function and not only on the system structure. EMR gives insights into the real energy operation of systems and allows a deep understanding of its potentialities from a dynamic point of view.

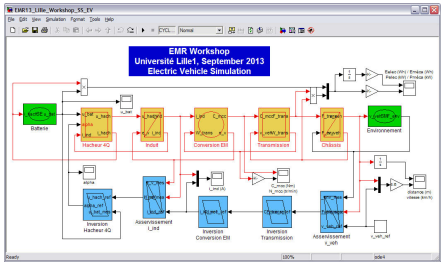
In short, the distinct features of EMR lie in its clarity of physical concepts, as well as their physical causality, and its functional modelling rather than a structural modelling. It hence contributes significantly to the design of control and energy management of systems.



Energetic Macroscopic Representation of a Wind Energy Conversion System

Simulation Training Sessions

The aim of this Summer School is to give first hand experience in practice of using EMR and inversion-based control. Two afternoons will be dedicated to simulation training sessions using MATLAB-Simulink©. Attendees will simulate a complete system and its control using EMR methodology. They will choose to study an electric vehicle, a photovoltaic system or a wind energy conversion system. An EMR library will be provided to all attendees.



MATLAB-Simulink© model of an Electric Vehicle (orange) and its control (blue) derived from EMR

Provisional Schedule

— Monday 9th of September 2013 —
9am – 1pm: Lectures on fundamentals on EMR and inversion-based control, basic examples
2pm – 6pm: Simulation training session (part I), modelling of the considered system

— Tuesday 10th of September 2013 —
9am – 1pm: Lectures on applications to complex systems (part I)
(Hybrid Electric Vehicles, Automatic subway traction systems, Fuel Cell systems…)
2pm – 6pm: Simulation training session (part II), control of the considered system

— Wednesday 11th of September 2013 —
9am – 1pm: Lectures on applications to complex systems (part II)
(wind energy conversion systems, PV systems, Piezoelectric actuators…)
2pm – 6pm: Practical training session (part III), analysis of the considered system

— Thursday 12th of September 2013 —
9am – 1pm: Preparation of case applications (PhD students)
2pm – 6pm: Presentation of case applications (PhD students)

The full program will be available at http://www.emrwebsite.org/

Language

Lectures will be presented in English. The simulation training session will be ensured in English.