University of Lille1
June 15th – 18th, 2015
www.emrwebsite.org

"Modelling and control using
ENERGETIC MACROSCOPIC REPRESENTATION
Application to hybrid electric vehicles and others"
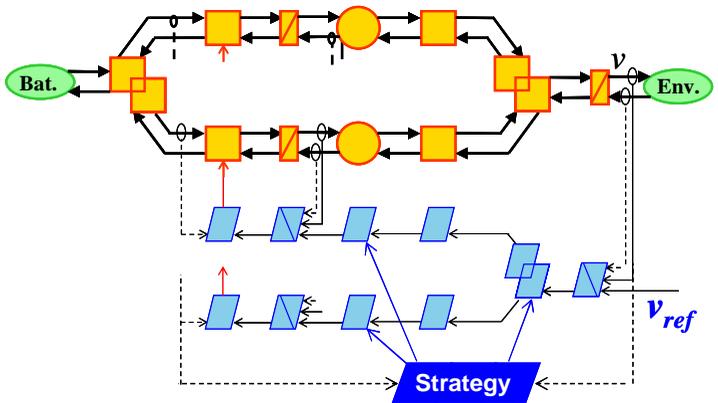

Lecture session, EMR'06, Lille (France)

Lecture session, EMR'08, Harbin (China)

Lecturers and part of attendees, EMR'09, Trois Rivières (Canada)

EMR and inversion-based control of an Electric Vehicle

Practical session, EMR'11, Lausanne (Switzerland)

Lecturers and part of attendees, EMR'12, Madrid (Spain)

Practical session, EMR'13, Lille (France)

Simulation session, EMR'14, Coimbra (Portugal)

Université de Lille 1 SCIENCES ET TECHNOLOGIES

MEGEVH *French network on HEV's*

VTS *Connecting the Mobile World*

EJIE

L2EP Laboratoire d'électrotechnique et d'électronique de puissance de Lille

Location
Polytech Lille, Avenue Paul Langevin 59655 Villeneuve d'Ascq France

3ECTS for foreign students and attendance certification for French students (doctoral schools)

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

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

EMR is a graphical modelling tool that was introduced in 2000 to describe complex electromechanical systems. EMR has since been extended to complex multi-physical 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 graphical description 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 structural 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.
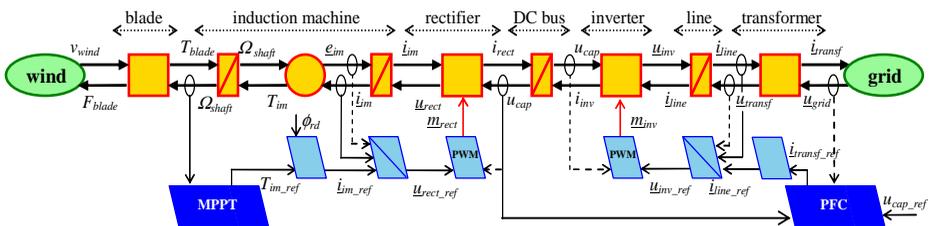

Energetic Macroscopic Representation of a Wind Energy Conversion System

EMR'06 - Lille (France), EMR'08 - Harbin (China), EMR'09 - Trois-Rivières (Canada), EMR'11 - Lausanne (Switzerland), EMR'12 - Madrid (Spain), EMR'13 - Lille (France), EMR'14 - Coimbra (Portugal)

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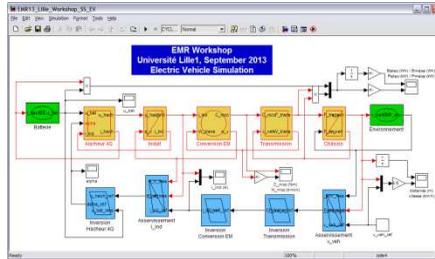
MATLAB®-Simulink® model of an Electric Vehicle (orange)
and its control (blue) derived from EMR

PROVISIONAL SCHEDULE

— Monday 15th of June 2015 —
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 16th of June 2015 —
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 17th of June 2015 —
9am – 1pm: Lectures on applications to complex systems (part II)
(wind energy conversion systems, PV systems, Piezoelectric actuators…)
2pm – 6pm: Practical training session, control of an electric drive

— Thursday 18th of June 2015 —
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 training sessions will be taught in English.

WORKSHOP ORGANIZATION

This workshop is organized by University of Lille1 (France).

General chair

Dr Frédéric GIRAUD (University of Lille1, L2EP, - France)

Co-chair

Prof. Alain BOUSCAYROL (University of Lille1, L2EP, MEGEVH, France)

Scientific committee

Dr. Philippe BARRADE (Ecole HES-SO Valais-Wallis, Switzerland)
Dr. Loïc BOULON (Université du Québec à Trois-Rivières, GRÉI, Canada)
Dr. Lucia GAUCHIA (MichiganTech University, USA)
Prof. Daniel HISSEL (University of Franche Comté, FEMTO-ST, MEGEVH, France)
Prof. Xavier KESTELYN (Arts&Métiers ParisTech, L2EP, France)
Prof. Betty LEMAIRE-SEMAIL (University of Lille1, L2EP, France)
Dr. Walter LHOMME (University of Lille1, L2EP, MEGEVH, France)
Dr. Daniel MONTESINO (Universitat Politècnica de Catalunya, Spain)
Prof João Pedro TROVAO (University of Sherbrooke, Canada)
Prof. Pierre SICARD (Université du Québec à Trois-Rivières, GRÉI, Canada)

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.

	Before May 1st	After May 1st
Students:	**75 €**	**150 €**
Regular:	**160 €**	**210 €**

University of Lille1 will provide attendance certification for French students (Doctoral School) and 3 ECTS to Master and PhD students from other countries.

INFORMATION

Contact: frederic.giraud@univ-lille1.fr
The summer school takes place in **Polytech Lille**, avenue Paul Langevin, cité scientifique , **59655 Villeneuve d'Ascq** France.
Métro 4 cantons
More information: http://www.emrwebsite.org/