

INTERNATIONAL SUMMER SCHOOL - EMR'14



GPS:
Latitude: 40°11'10.38"N
Longitude: 8°24'59.13"W

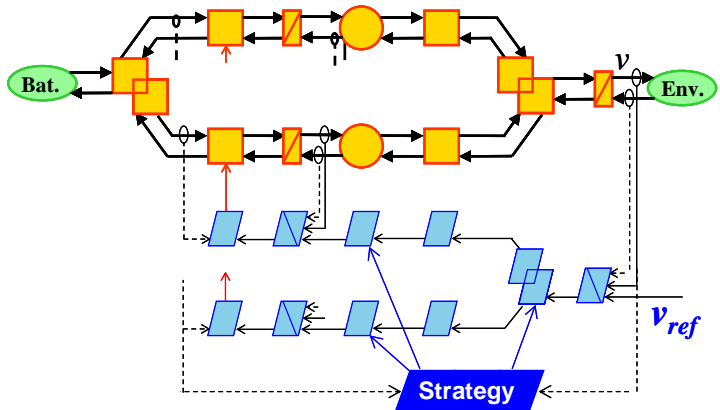
University of Coimbra, Portugal
Department of Electrical and Computer Engineering
June 16th – 18th, 2014

www.emrwebsite.org

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



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



EMR and inversion-based control of an dual-motor Electric Vehicle



Organization:



Technical Co-Sponsorship:



WORKSHOP OBJECTIVES

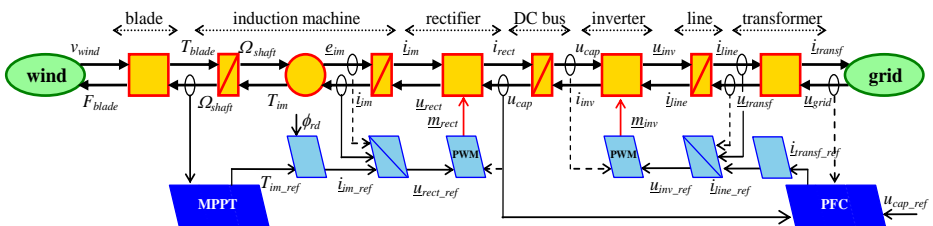
This workshop is focused on the Energetic Macroscopic Representation (EMR) methodology for modelling and control of complex electromechanical systems.

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 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 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.

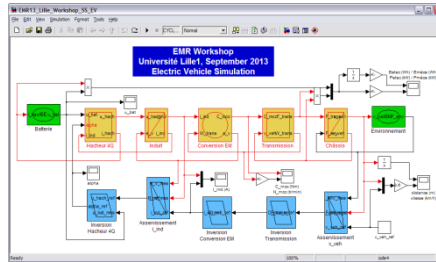
In short, the distinct features of EMR lie in its clarity of physical concepts, as well as their physical causality, and its functional modelling rather than a structural modelling. It hence contributes significantly to the design of control and energy management of systems.



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 16th of June 2014 —

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 17th of June 2014 —

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 18th of June 2014 —

9am – 1pm: Lectures on applications to complex systems (part II)
(wind energy conversion systems, PV systems, Piezoelectric actuators...)
2pm – 6pm: Simulation training session (part III), strategy definition of the considered system

— Thursday 19th of June 2014 —

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.

WORKSHOP ORGANIZATION

This workshop is a joint Summer School between INESC Coimbra (Portugal), and Université Lille1 (France).

General chair

Dr. João Pedro TROVÃO (Polyt. Instit. of Coimbra, INESC Coimbra, APVE Portugal)

Co-chair

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

Scientific committee

Prof. Carlos Henggeler ANTUNES (University of Coimbra, INESC Coimbra, Portugal)

Dr. Philippe BARRADE (Ecole Polytechnique Fédérale de Lausanne, LEI, Switzerland)

Dr. Loïc BOULON (Université du Québec à Trois-Rivières, GRÉI, Canada)

Prof. Daniel HISSEL (University of Franche Comté, FEMTO-ST, MEGEVH, France)

Dr. Xavier KESTELYN (Arts&Métiers ParisTech, L2EP, France)

Prof. Betty LEMAIRE-SEMAIL (Université Lille1, L2EP, France)

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

Prof. Paulo G. PEREIRINHA (Polyt. Instit. of Coimbra, INESC Coimbra, APVE Portugal)

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 31th	After May 31th
Students:	50 €	75 €
Regular:	100 €	150 €

INFORMATION

Contact: jtrovao@isec.pt

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), EMR'13 - Lille (France)