

« Modelling and control using
Energetic Macroscopic Representation
Application to hybrid electric vehicles and others »

Université de Lille



EMR'21 Summer School, 14-17 June 2021

including the doctoral day, 17 June 2021

<http://www.emrwebsite.org/>

The PhD students, who attend to both EMR'21 and the doctoral day, will receive 3 ECTS from the doctoral school of Lille University, if they succeed the assessment.

Potential supports



Preliminary program

| Monday June 14 th : "EMR and fundamentals" (room tbc) | |
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| 08h30 | -- Welcome and registration -- |
| 09h00 | Welcome session - Introduction (<i>Prof. B. Lemaire-Semail, Univ. Lille, L2EP, France</i>) |
| Oral session 1: From the causality to the EMR – From the EMR to the control (<i>session chair: to be defined</i>) | |
| 09h30 | 1.1 - "About energy and causality principles" (<i>Prof. A. Bouscayrol, Univ. Lille, L2EP, France, Prof. C.C. Chan, Univ. Hong-Kong, China</i>) |
| 10h00 | 1.2 - "Energetic Macroscopic Representation" (<i>Prof. J. Trovao, Univ. Sherbrooke, Canada, Prof. A. Bouscayrol, Univ. Lille, L2EP, France,</i>) |
| 10h30 | 1.3 - "Inversion-based control" (<i>Prof. B. Lemaire-Semail, Prof. A. Bouscayrol, Univ. Lille, L2EP, France</i>) |
| 11h00 | -- Coffee break -- |
| Oral session 2: Basic examples (<i>session chair: to be defined</i>) | |
| 11h30 | 2.1 - "EMR and inversion-based control of an electric vehicle" (<i>Prof. Minh, Univ. Hanoi of science and tech., Vietnam, Prof. A. Bouscayrol, Univ. Lille, L2EP, France</i>) |
| 11h50 | 2.2 - "EMR and inversion-based control of a renewable energy conversion system" (<i>Prof. L. Boulon, Univ. Quebec à Trois-Rivieres, Canada, Dr. P. Delarue, Univ. Lille, L2EP, France</i>) |
| 12h10 | 2.3 - "EMR and inversion-based control of a lift system" (<i>Prof. P. Barrade, HES Valais, Sion, Switzerland,</i>) |
| 12h40 | -- Lunch -- |
| Simulation session 1: Modelling, Introduction to simulation (<i>1 case study to choose among the following</i>), P2 building, room 116 | |
| 14h00 Group 1 | " Electric vehicle using EMR and Simulink™: part 1, EMR " (EV) (<i>Dr. R. German, Univ. Lille, L2EP</i>) |
| 14h00 Group 2 | " Wind energy conversion system using EMR and Simulink™: part 1, EMR " (WECS) (<i>Dr. P. Delarue, Univ. Lille, L2EP</i>) |
| 14h00 Group 3 | " Photovoltaic system using EMR and Simulink™: part 1, EMR " (PV) (<i>Dr. W. Lhomme, Univ. Lille, L2EP</i>) |
| 14h00 Group 4 | " Elevator system using EMR and Simulink™: part 1, EMR " (ES) (<i>Dr. P. Barrade, Univ. Sion, Switzerland</i>) |
| 17h30 | -- End of day 1 -- |

| Tuesday June 15 th : "EMR and applications" (part I) (room tbc) | |
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| Oral session 3: Other applications 1 (OA – 1) (<i>session chair: to be defined</i>) | |
| 08h30 | 3.1 "Comparison of control for particle injector using EMR" (<i>C. Ortega-Perez, P. Delarue, J.M. Cravero, D. Aguigula, CERN, Switzerland,, Univ. Lille France,</i>) |
| 08h50 | 3.2 "Fault tolerant control of a multiphase drives using EMR" (<i>Tan Duc Vu, N. Nguyen, E. Semail, D. T. Dos Santos, ENSAM Lille, L2EP, France</i>) |
| 09h10 | 3.2 "Control of Modular Cascade Machine for EV using EMR" (<i>K. Li, A. Bouscayrol, S. Cui, Harbin Inst. Tech., China Univ. Lille, L2EP, France,</i>) |
| Oral session 4: Transportation Applications 1 (TA – 1) Organized by "e-CAMPUS" international lab (<i>session chair: Dr HDR Elodie Castex, TVES, Univ. Lille , France</i>) | |
| 09h30 | 4.1 "Automatic driving cycle generator for EV using EMR" (<i>A. Desreveaux, R. Trigui, E. Castex, A. Bouscayrol, Univ. Lille, L2EP TVES, LTE-ISFFATR, France</i>) |
| 09h50 | 4.2 "Energy consumption of EV under various climatic condition suing EMR" (<i>D. Ramsey, L. Boulon, A. Bouscayrol, Univ. Trois-Rivières, Canada,, Univ. Lille, L2EP, France</i>) |
| 10h10 | 4.3 "EMR and control of an Autonomus Vehicle" (<i>S. Kelouwani, L. Boulon et al., Univ. Quebec à Trois-Rivieres, Canada</i>) |
| 10h30 | -- Coffee break -- |

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| Oral session 3: Transportation Applications 2 (TA - 2) Organized by MEGEVH <i>(session chair: Pr. Samir Jemai, Univ. Franche Comté, France)</i> | |
| 11h00 | 5.1 "Energy consumption of an electric motorbike using EMR" <i>(R. German, A. Bouscayrol, Univ. Lille, L2EP, France, J.P. Trovao, Univ; Sherbrooke, Canada)</i> |
| 11h20 | 5.2 "EMR and HIL testing for battery testing of a HEV" <i>(A. Pam P. Fiani, A. Bouscayrol Univ. Lille, L2EP, France, Sherpa Engineering, France)</i> |
| 11h40 | 5.3 "Optimization of HESS hybrid truck fuel consumption by using EMR and LQR" <i>(B.H. Nguyen R. German, A. Bouscayrol, Univ. Lille, L2EP, France, J.P. Trovao, Univ; Sherbrooke, Canada)</i> |
| Round Table 1 (RT – 1) EMR education <i>(session chair: Prof. Paulo Pereririnha, INESC Coimbra, Portugal)</i> | |
| 12h00 | <i>Prof. A. Bouscayrol, Univ. Lille, L2EP, France</i> <i>Prof. T.C. Minh, Hanoi University of Science and Technology, Vietnam</i> <i>Prof. P. Barrade, HES Valais, Sion, Switzerland</i> <i>Prof. D. Montesinos Miracle, Univ. Polytech. Catalunya, Spain</i> <i>Prof. J.P. Trovao, Univ; Sherbrooke, Canada</i> |
| 13h00 | -- Lunch -- |

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| Simulation session 2: Inversion-based control, Introduction to simulation <i>(the participants will complete the case study they have chosen the day before), P2 building room 116</i> | |
| 14h30 Group 1 | " Electric vehicle using EMR and Simulink™: part 2, inversion-based control " (EV) <i>(A. Pam, Univ. Lille 1, L2EP)</i> |
| 14h30 Group 2 | " Wind system using EMR & Simulink™: part 2, inversion-based control " (WECS) <i>(A. Desresveaux, Univ. Lille 1, L2EP)</i> |
| 14h00 Group 3 | " Photovoltaic system using EMR and Simulink™: part 2, inversion-based control " (PV) <i>(D. Ramsey, Univ. Lille 1, L2EP)</i> |
| 14h00 Group 4 | " Elevator system using EMR and Simulink™: part 2, inversion-based control " (ES) <i>(Dr. P. Barrade, Univ. Sion, Switzerland)</i> |
| 18h00 | -- End of day 2 -- |

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| Wednesday June 16th : "EMR and applications" (part II) (room tbd) | |
| Oral session 7: Transportation Applications 3 (TA - 3) Organized by IEEE-VTS committee <i>(session chair: Prof. Loic Boulon, Univ. Trois Rivières, Canada)</i> | |
| 08h30 | 7.1 "EMR of a new generation of automatic subway " <i>R. O'Beriel, P. Delarue, A. Bouscayrol C. Brocary, Univ Lille, L2EP, MEL France</i> |
| 08h50 | 7.2 "EMR and scalability for "different electric vehicles" <i>A. Aroua, Dr. W. Lhomme, F. Verbelen, K. Stockman., Univ. Lille, France, Univ. Ghent, Belgium</i> |
| 09h10 | 7.3 "Electro-thermal model of a battery for EV using EMR" <i>A. Ndiaye, R. German, A,</i> |
| Oral session 8: Other Applications 2 (OA – 2) <i>(session chair: to be defined)</i> | |
| 09h30 | 8.1 "Piezzo-electric actuators for high frequency haptic surface " <i>Dr. C. Giraud-Audine, F. Giraud, B. Lemaire-Semail., ENSAM Lille, L2EP, France</i> |
| 09h50 | 8.2 "Human-in-the-loop for tactile application using EMR" <i>A. Torrez-Guzman, B. Lemaire-Semail, F. Giraud., Univ. Lille, L2EP</i> |
| 10h10 | 8.3 " Hardware-In-the-loop of power traction substation using EMR" <i>L. Ferreira, P. Delarue, A. Bouscayrol, C. Brocart, Univ. Lille, France and MEL</i> |
| 10h30 | -- Coffee break -- |
| Oral session 9: Transport Application 4 (TA – 4) <i>(session chair: E. Hittingerl, Rochester Institute of Technology, USA)</i> | |
| 11h00 | 9.1 "EMR for signal hardware in the loop tests of power electronics" <i>A. Genic, Typhoon, Serbia, P. Barrade, Univ. Sion, Switzerland.</i> |
| 11h20 | 9.2 "Multi-level simulation of a Battery electric vehicle using the AMESIM EMR library" |

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| | <i>C. Hussar, C. Irimia (Siemens Software) A. Desrevaux (Univ. Lille, L2EP, France)</i> |
| 11h40 | 9.3 "EMR Digital Twin Real-Time FPGA for electric Drives" <i>M. Ruba, C. Martis, Univ. Cluj Napoca, Romania, A. Bouscayrol, Univ. Lille, L2EP, France, et al.</i> |
| Oral session 10: Other Applications 3 (OA – 3) PANDA project <i>(session chair: to be Prof. Claudi Martis, Univ. Cluj Napoca, Romania)</i> | |
| 12h00 | 10.1 "EMR and control of a fuel cell vehicle" <i>D. Chrenko et al., UTBM, FEMTO-ST, France</i> |
| 12h20 | 10.2 "EMR and control of a Plug-in Hybrid electric Vehicle " <i>F. Tournez, W. Lhomme, A. Lièvre, M. Reynaour, Univ. Lille, L2EP, France, Valeo, France</i> |
| 12h40 | 10.3 "EMR and control of a Battery Electric Vehicle" <i>A. Desrevaux, (Univ. Lille, L2EP, France), G. Serbu (Renault TR, Romania)</i> |
| 13h00 | -- Lunch -- |

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| Simulation session 2: Inversion-based control, Introduction to simulation <i>(the participants will complete the case study they have chosen the day before), P2 building room 116</i> | |
| 14h30 Group 1 | " Electric vehicle using EMR and Simulink™: part 3, energy management " (EV) <i>(A. Pam, Univ. Lille 1, L2EP)</i> |
| 14h30 Group 2 | " Wind system using EMR & Simulink™: part 3, energy management " (WECS) <i>(A. Desrevaux, Univ. Lille 1, L2EP)</i> |
| 14h00 Group 3 | " Photovoltaic system using EMR and Simulink™: part 3, energy management " (PV) <i>(D. Ramsey, Univ. Lille 1, L2EP)</i> |
| 14h00 Group 4 | " Elevator system using EMR and Simulink™: part 3, energy management " (ES) <i>(Dr. P. Barrade, Univ. Sion, Switzerland)</i> |
| 18h00 | -- End of day 3-- |

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| Thursday June 17^h : "Doctoral day (room tbd) | |
| Free activity of the PhD students (and other volunteers) | |
| 09h00 | From defined exercises, the students will apply the EMR-IBC methodology. They will prepare some PPT presentations in order to explain their approach and main results. |
| 12h30 | -- Lunch -- |
| 14h00 | From the PPT presentations prepared, each student must present to the audience the results of the exercises they have worked on. |
| 18h00 | -- End of the day -- |

