



EMR'23, Lille (France)

« Introduction OF EMR'23 Summer school »

Dr. Christophe GIRAUD-AUDINE, Prof. Alain BOUSCAYROL
L2EP, Arts&Métiers Sciences et Technologies, University of Lille, France



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Univ. Lille & L2EP

2

EMR summer schools

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EMR'23 organization



EMR'23, Lille (France)

« University of Lille & L2EP »

Dr. Christophe GIRAUD-AUDINE,
(Arts & Métiers Sciences et Technologies, L2EP)



Introduction of EMR'23

- University of Lille

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EMR'23, Lille, June 2023

at the crossroad of Paris, London and Brussels

Lille and suburbs more than 1.5 million inhabitants



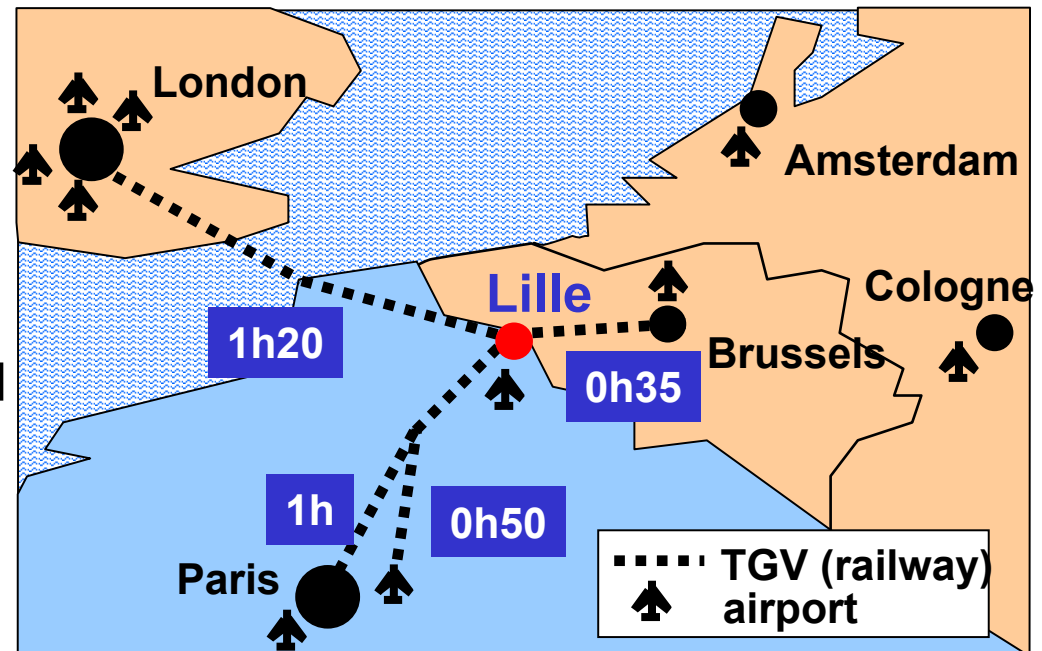
Université
de Lille

University of Lille

72,000 students, 12% from abroad

66 research labs

<https://www.univ-lille.fr/home/>

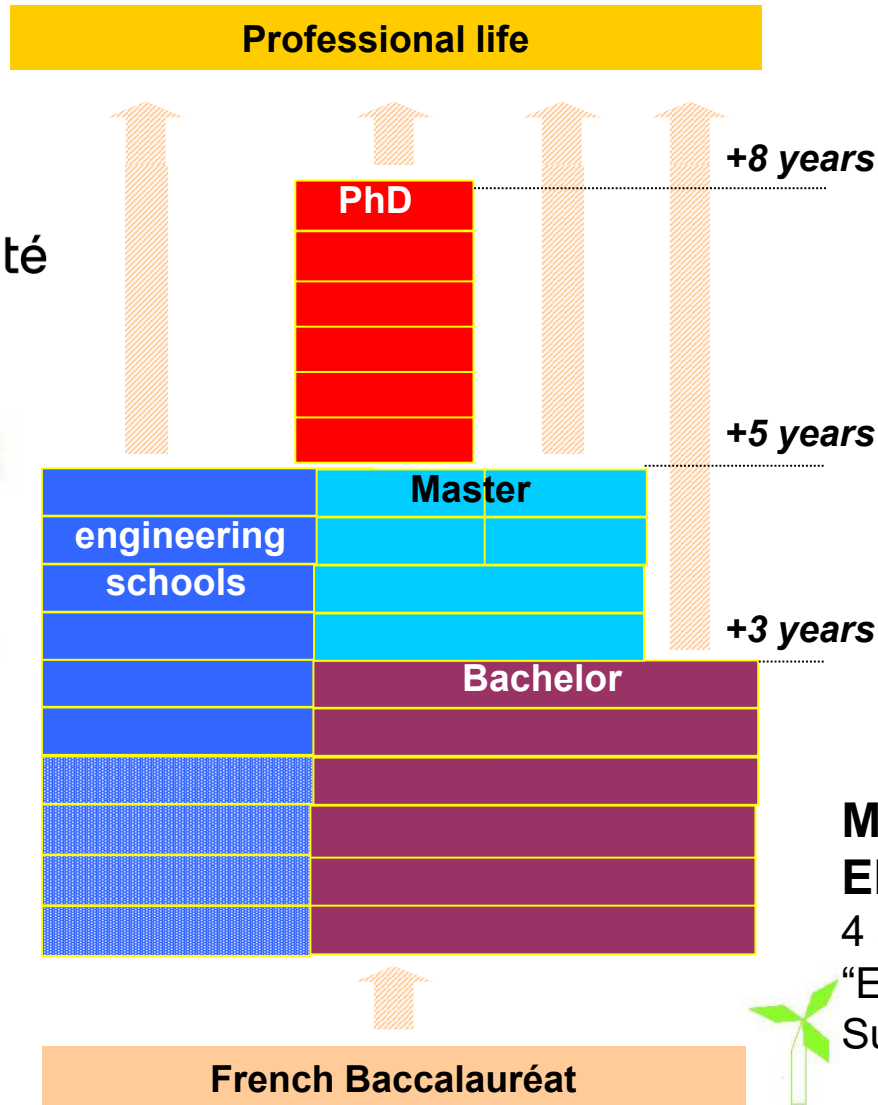


Introduction of EMR'23

- Education in France and at Lille -

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Fields of study :

Social and human sciences
Economy and management
Sciences and technologies
computer sciences
control engineering
electrical engineering
mechanics engineering
telecommunications...

Master « Automatic control and Electrical engineering »

4 specialties including
“Electrical Engineering for Sustainable development” in English



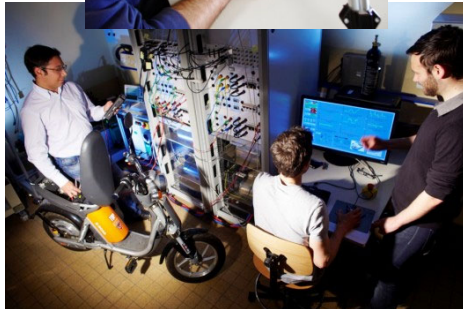
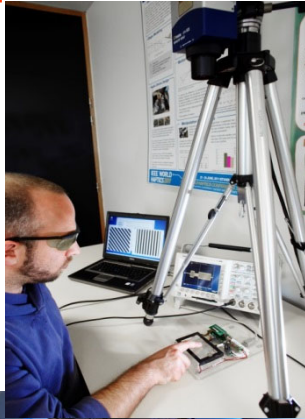
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- L2EP Lille -

<http://l2ep.univ-lille.fr/>

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More than 120 members : 38 professors and associate professors, 40 PhD students, 15 lab's staff, Post-doctoral positions, Master students, etc.



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- Research at L2EP -

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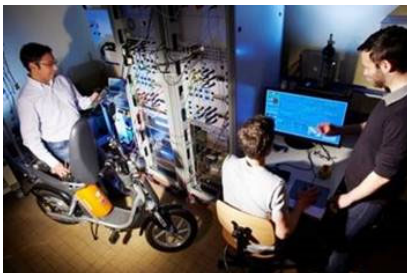
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Prof. Betty LEMAIRE-SEMAIL

Control

Prof. Alain BOUSCAYROL



Power electronics

Prof. Philippe LE MOIGNE



Numerical tools & methods

Prof. Abdelmounaim TOUNZI



Power grids

Prof. Benoit ROBYNS



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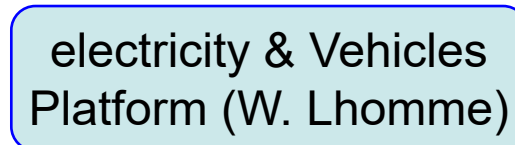
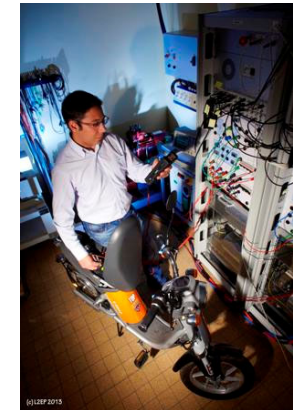
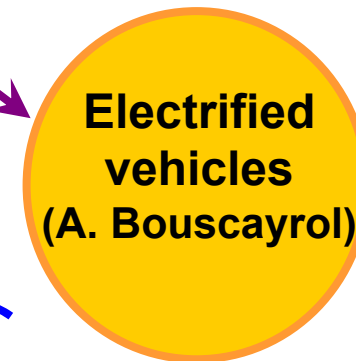
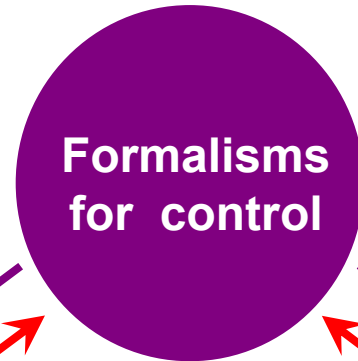
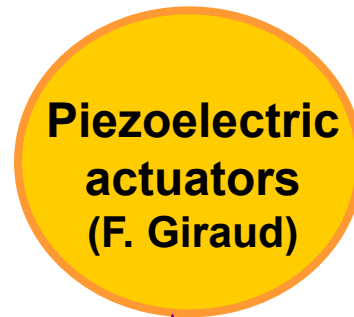
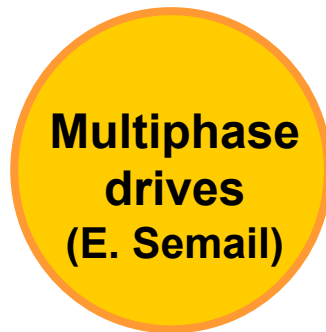
- "Control" team of L2EP -

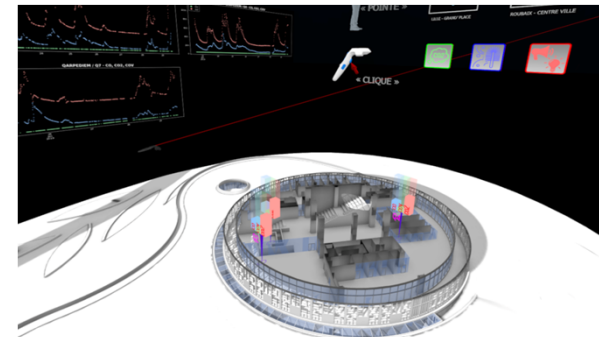
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Objective
Control for innovative
and efficient
« electrical systems »

April 2023
4 Professors
4 Associate Prof.
4 Engineers
1 Technician
2 Post-Doc
12 PhD students
4 Master students





Advanced IHM



Tactile feedback touchscreen

Internet of Things

Tactile and gestural interaction

Photonic

Bio-inspired Architectures





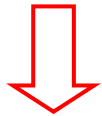
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Energetic Macroscopic Representation (EMR)

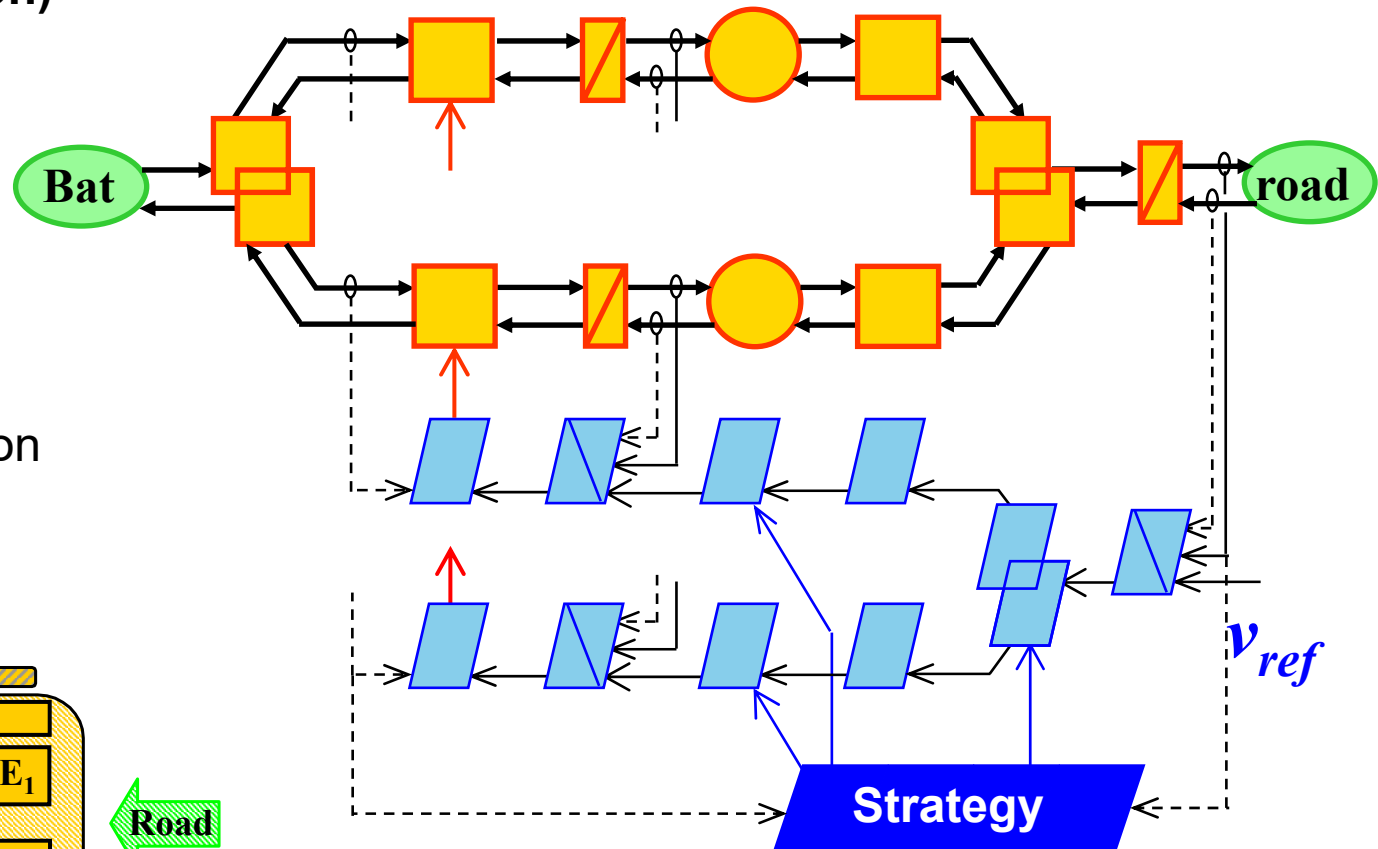
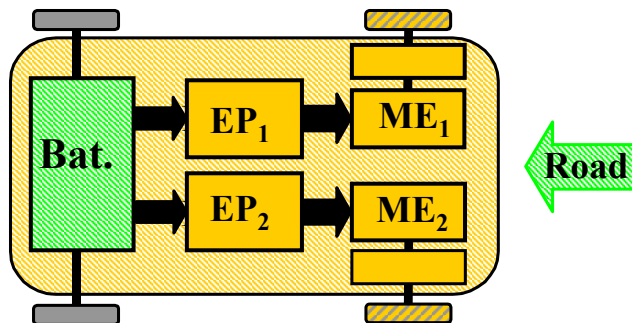
Prof. Alain BOUSCAYROL,
(Univ. Lille, L2EP)

EMR
(graphical description)

=
organization
of models of
complex systems



Systematic deduction
of organization of
control schemes



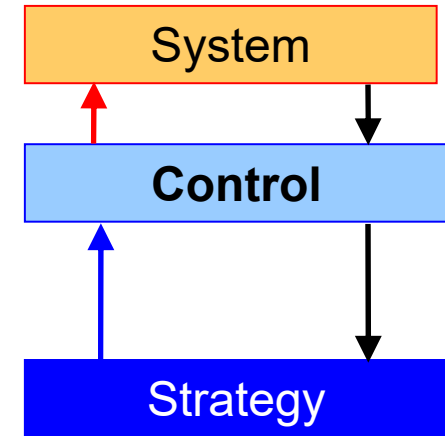
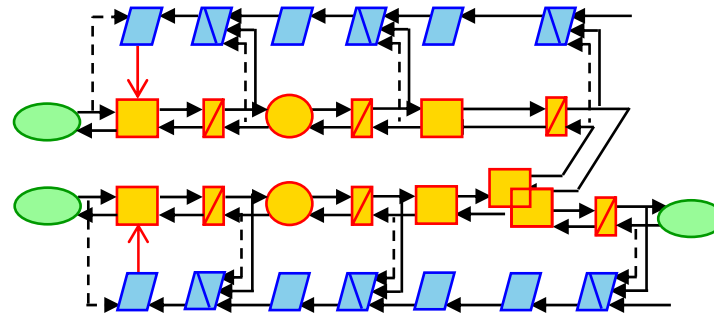
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- EMR development -

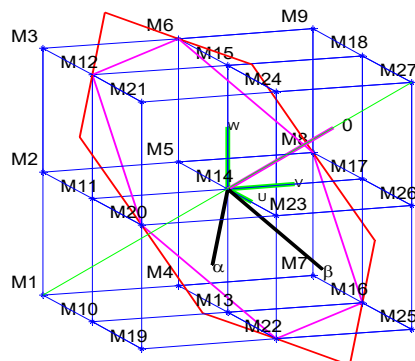
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Energetic
Macroscopic
Representation
(EMR)



2000 2005 2010 2015 2020



Generalized
Vectorial
Formalism
(GVF)

model reduction
strategies organization

Strategy: generation of global references / coordination of subsystems

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- EMR and Education -

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University of Lille, Polytech Lille, EC Lille

Master 1: EMR initiation

Master 2: EMR further development

Other French Universities and Engineering Schools

Cachan (2004) Belfort (2006), ParisTech (2010),
Compiègne (2012), Polytech Paris Sud (2014), etc.

Universities abroad France

Univ. Trois-Rivières, Canada (2002)

EPF Lausanne, Switzerland (2005)

Harbin Institute of Technology, China(2008)

Univ. Tsinghua, Beijing, China(2008)

UPC, Barcelona, Spain (2010)

Univ. Graz, Austria (2012)

INES Coimbra, Portugal (2014)

Univ. Ap. Sc. Sion, Switzerland (2015)

Univ. Sherbrooke, Canada (2015)

Univ. Oviedo, Spain (2016)

Univ. Santander, Colombia (2017)

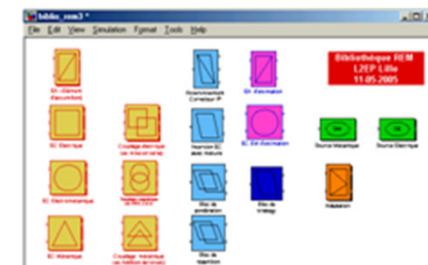
Univ. Hanoi, Vietnam (2018)...



Simulation session, EMR'08, Harbin



Lecture session, EMR'12, Madrid



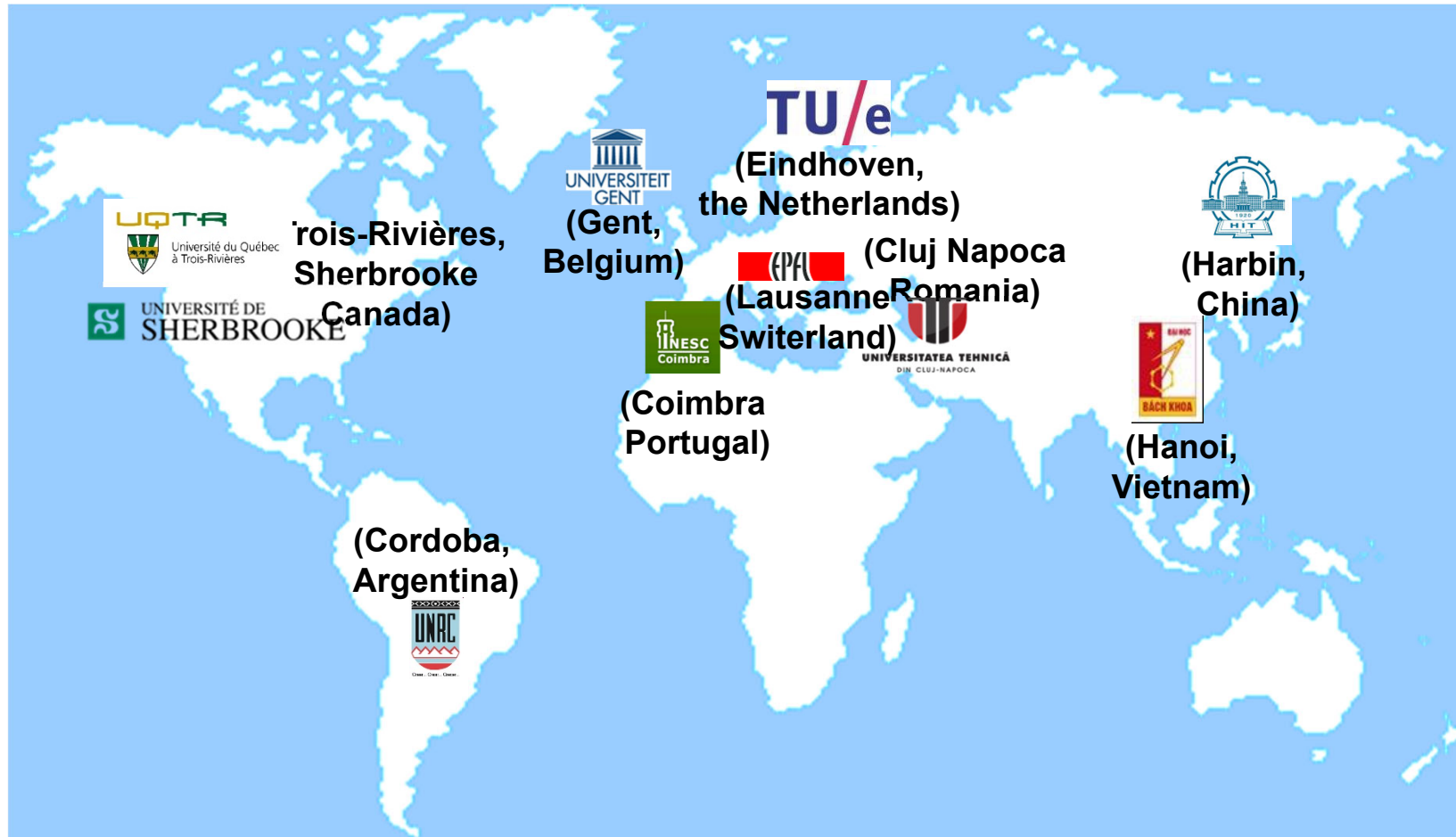
EMR Simulink library

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- EMR & collaboration -

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Industry:



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- EMR Summer Schools -

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Starting 2006, since 2011 annual, since 2013 odd years in Lille, even years abroad

Logos and Institutions:

- UQTR Université du Québec à Trois-Rivières
- UNIVERSITÉ DE SHERBROOKE
- Université Lille1 Sciences et Technologies
- L2EP Laboratoire d'électrotechnique et d'électronique de puissance de Lille
- Université de Lille
- INESC Coimbra
- Universidad Carlos III de Madrid
- EPFL
- Hes-so
- BACH KHOA
- 哈爾濱工業大學 (HARBIN INSTITUTE OF TECHNOLOGY)

Locations and Years:

- EMR'09, Trois-Rivières (Canada)
- EMR'16, Montréal (Canada)
- EMR'06, EMR'13, EMR'15, EMR'17, EMR'19, 21 Lille (France)
- EMR'14, Coimbra (Portugal)
- EMR'12, Madrid (España)
- EMR'11, Lausanne (Suiza)
- EMR'21, Sion (Suiza)
- EMR'18, Hanoi (Vietnam)
- EMR'08, Harbin (China)



EMR'23, Lille (France)

« EMR'21 Summer School »

Dr. Christophe GIRAUD-AUDINE,
(Arts & Métiers Sciences et Technologies, L2EP)



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- EMR'23 Organization -

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hybrid mode!

114 participants from 17 countries (55 in presence)



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- Hybrid Organization -

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concept lectures

application lectures

simulation

Paris UTC+2	Hanoi UTC+7
9:00	14:00
9:30	14:30
10:00	15:00
10:30	15:30
11:00	16:00
11:30	16:30
12:00	17:00
12:30	17:30
13:00	18:00
7:30	13:30

Monday 12
Registration ESPRIT

Tuesday 13
Simulation part 1
P2-110 & on-line

Wednesday 14
Simulation part 2
P2-110 & on-line

Thursday 15
Simulation part 3
P2-110 & on-line and VISITS

simulation
connexion
from
Africa
Asia
Europe

**local
+ on-line
for Asia,
Africa
Europe**

Lunch Barrois Lunch Barrois Lunch Barrois Lunch Barrois

**on-line
for North
& South
America**

8:00	14:00	19:00
8:30	14:30	19:30
9:00	15:00	20:00
9:30	15:30	20:30
10:00	16:00	21:00
10:30	16:30	21:30
11:00	17:00	22:00
11:30	17:30	22:30
12:00	18:00	23
12:30	18:30	23
13:00	19:00	0:
13:30	19:30	0:
14:00	20:00	1:
14:30	20:30	1:
15:00	21:00	2:
15:30	21:30	2:
16:00	22:00	3:

Introduction
Systemics
EMR & control
Basic examples
SW & HW

CUMIN session
VPP Techcom session
EMR in education

Railway application
HIL Session
Special applications

Special applications
Power electronics
E-Drive

lectures on
concepts
applications
IRCICA
building

Simulation part 1
on-line

Simulation part 2
on-line

Simulation part 3
on-line

simulation
connexion
from
America

You have to select 1 of the 2 options

1. Matlab-Simulink In-presence

P2-110, P2 building
Univ. Lille

Classical for
the summer school
no particular needs!



2. Matlab-Simulink On-line Using ZOOM

2.1 with your own
Matlab-Simulink
No particular needs!

2.2. with the free
30-day Matlab trial
(see EMR21-Matlab
On-line.pdf)

**Register
in advance!**

Our simulation team (12 volunteers) will help you!

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- EMR'23 supports -

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Thanks to our valuable supports!

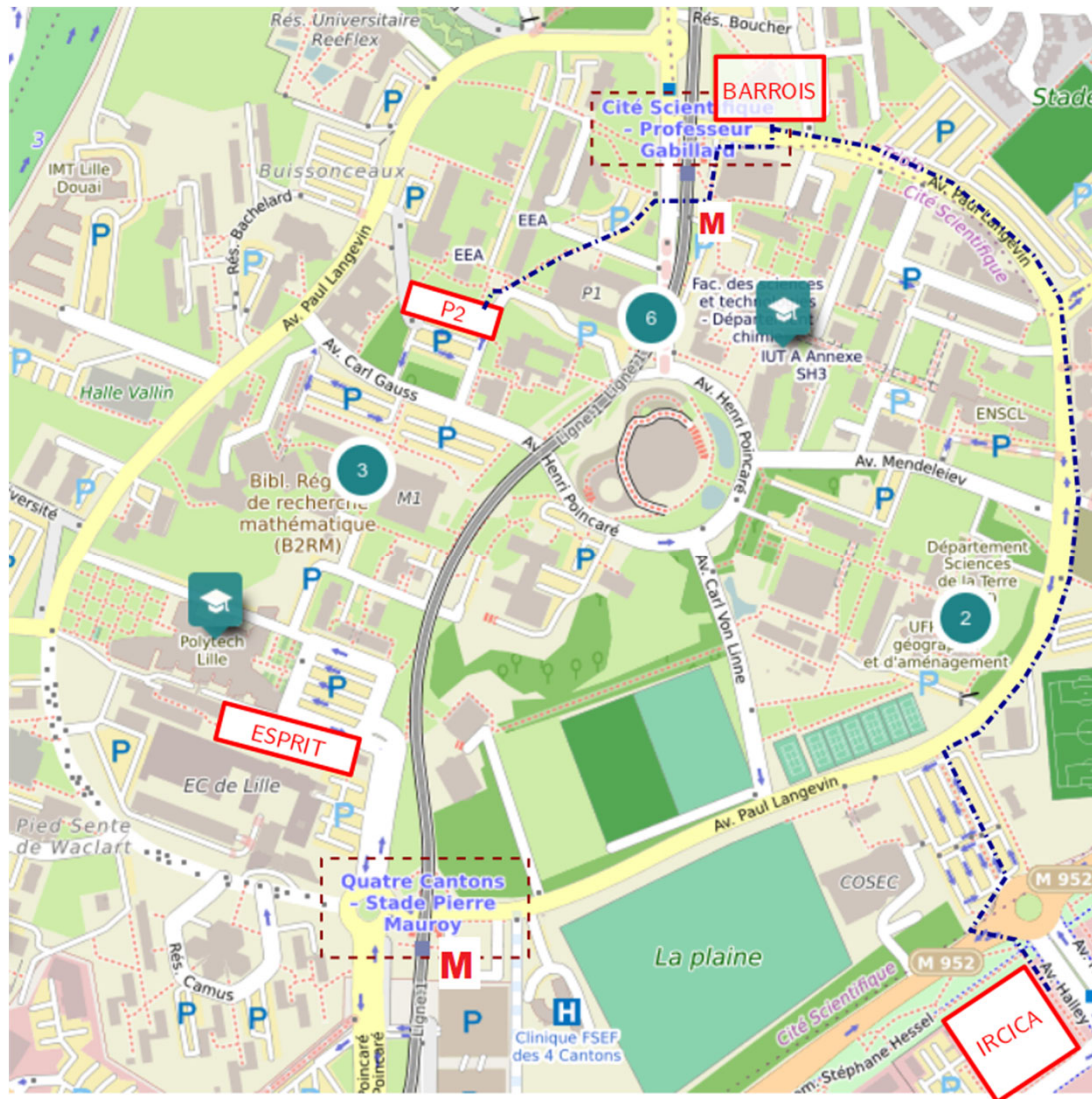


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- EMR'23 map -

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Introduction of EMR'23

- EMR documents -

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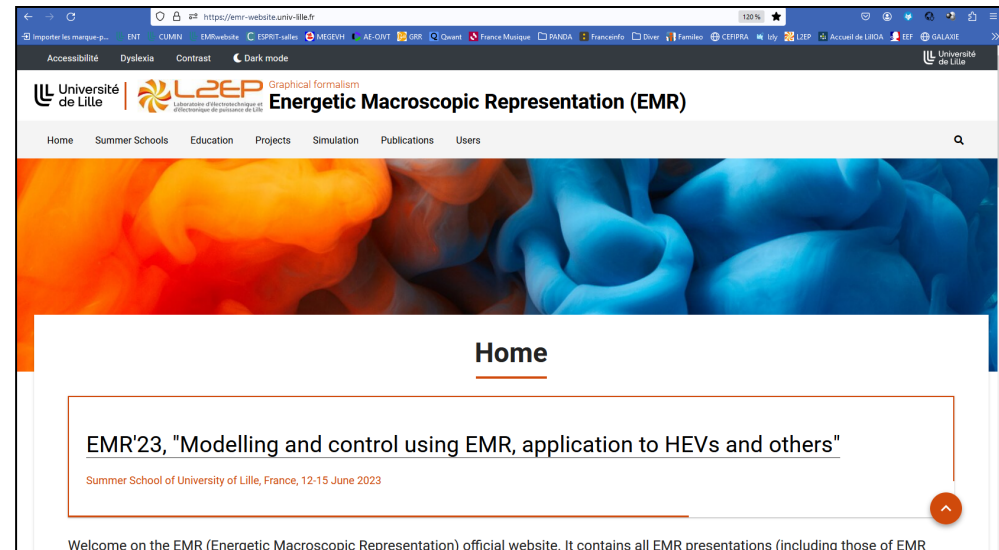
During EMR23: EMR-cloud (guidelines, simulation files, presentations the day after)
see your information e-mail



After EMR23:
EMR web-site

All documents available
next week at
<http://emrwebsite.org>

Webmaster: Ryan O'BERRIEL



Any question: christophe.giraud-audine@ensam.eu

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Miscellaneous

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Problem with ZOOM?
Stop & Restart = 75% of solutions

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Summer school »

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L2EP, Arts&Métiers Sciences et Technologies, University of Lille, France

Arts et Métiers Université de Lille

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

Chat Lever la main Q. et R.

During lectures

- turn off microphone
- open your mind!

(increase of the flow quality)

For questions

- ask your question by Q&R
 - chairman gives you the floor
 - turn on your microphone
- give your name & affiliation
and take the question

(no question = no interest)



CHAT: for general issues or info only
(lack of sound, screen share, etc.)



EMR'23, Lille (France)

« BIOGRAPHIES AND REFERENCES »

Introduction of EMR'23

- Authors -

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Christophe GIRAUD-AUDINE, Arts et Métiers
Science & Technology, L2EP,

PhD in Electrical Engineering at INP Toulouse(1998)

Research topics: piezoelectric actuators & applications
using EMR, vibration control in automotive electric drives

christophe.giraud-audine@ensam.eu



Prof. Alain BOUSCAYROL, University of Lille, L2EP,
Head of the Master “Automatic control & Electrical Systems”
Coordinator of the CUMIN interdisciplinary programme
Chair of the steering committee of IEEE-VPP Conference
PhD in Electrical Engineering at University of Toulouse (1995)
Research topics: EMR formalism, HIL testing, control & EV-HEVs

Alain.Bouscayrol@univ-lille.fr

- [Bouscayrol 2000] A. Bouscayrol, & al. "Multimachine Multiconverter System: application for electromechanical drives", *European Physics Journal - Applied Physics*, vol. 10, no. 2, May 2000, pp. 131-147 (common paper GREEN Nancy, L2EP Lille and LEEI Toulouse, according to the SMM project of the GDR-SDSE).
- [Bouscayrol 2012] A. Bouscayrol, J. P. Hautier, B. Lemaire-Semail, "Graphic Formalisms for the Control of Multi-Physical Energetic Systems", *Systemic Design Methodologies for Electrical Energy*, tome 1, Analysis, Synthesis and Management, Chapter 3, ISTE Willey editions, October 2012, ISBN: 9781848213883
- [Bouscayrol 2023] A. Bouscayrol, B. Lemaire-Semail, "Energetic Macroscopic Representation and Inversion-Based Control ", *Encyclopedia of electrical and electronic power engineering*, Vol. 3, pp 365-375, Elsevier, DOI : 10.1016/B978-0-12-821204-2.00117-3, ISBN : 978-0-12-823211-8, 2023
- [Lhomme 2014] W. Lhomme, P. Delarue, A. Bouscayrol, P. Barrade, "La REM, formalismes multiphysique de commande des systèmes énergétiques", *Les Techniques de l'Ingénieur*, Référence D3066, Novembre 2014 (text in French, lift example)