Pierre HAESSIG   age : 26

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Energy Storage for Wind Power
PhD student

Education in Electrical Engineering, Control & Signal Processing

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2011–2014 **PhD student** on Energy Storage Sizing and Management for Wind Power, with the electric utility EDF, R&D department, and the SATIE CNRS laboratory at ENS Rennes, *Rennes, France*

2010–2011 **Master** degree in Control & Signal Processing at Supélec, *Gif-sur-Yvette, France*
Research internship at the Laboratory of Signals and Systems (L2S) at Supélec

2009–2010 French "Agrégation" examination in Applied Physics at ENS Cachan, *Paris, France*
Ranked first in this highly competitive test which is required by the French Education Ministry for teaching high school and undergraduate students.
Research internship at MIT (2 months), *Cambridge, USA*

2008–2009 1st year of **Master** degree in Electrical Engineering at ENS Cachan, *Paris, France*
Research internship at MIT (7 months), *Cambridge, USA*

2007–2008 **Licence** degree, the equivalent of a Bachelor's degree, in Electrical Engineering at the Paris-Sud University and at ENS Cachan, *Paris, France*

2005–2007 Completed the two-year French program "Classes Préparatoires" in Mathematics and Physics to pass the competitive admission tests for ENS Cachan, one of the French leading schools preparing for research and teaching careers, *Strasbourg, France*

Communication & Computing Skills

Language
- **French** : mother tongue
- **English** : 9 months of internships in the USA, presentations in international conferences
  TOEFL : 110/120, TOEIC : 990/990 in 2008
- **German** : basic skills, many exchanges and visits in Germany

Computer, *with emphasis on tools for reproducible scientific computing*
- **Python** used extensively for PhD research
  (including IPython Notebook interactive computational documents)
  — analysis and modeling of field data (time series)
  — Monte Carlo simulations of Energy Storage Systems
  — energy management optimization with Dynamic Programming
- **R** software used on a daily basis for Master research internship
  — statistical modeling of field data
  — time series modeling
- **Matlab/Simulink** used on a daily basis in previous research internships and throughout the Electrical Engineering curriculum at ENS Cachan
- **Software development tools** : code and document versioning (svn, git) used every day, documentation generator (sphinx) and code unit testing (nose) used regularly.

Research Experience

PhD research at the SATIE CNRS laboratory, ENS Rennes, France *2011–2014*
supervised by Bernard MULTON and Hamid BEN AHMED on the academic side,
and Stéphane LASCAUD at EDF R&D on the industrial side

Sizing and optimal control of an energy storage associated with wind power generation
— realistic modeling of energy storage systems (with losses and aging)
— modeling the temporal structure of errors of wind power forecasts
— optimization of the energy management of a storage taking into account the forecast uncertainty
(with Dynamic Programming)

Master thesis at L2S, Supélec, Gif-sur-Yvette, France *2011, 4 months*
supervised by Pascal BONDON

Characterizing the uncertainty of wind power generation
— modeling the uncertainty in the relation between wind speed and wind power production
— modeling forecast errors with a conditionally heteroscedastic model

Research internship at ISN, MIT, Cambridge, USA *2010, 2 months*
supervised by Ivan ČELANOVIĆ
and in collaboration with Félix HARTMANN, Michel KINSY et Jason POON

Platform for the real-time simulation of power electronics systems
— interfacing the PC-based modeling software and the FPGA-based simulation platform with an Ethernet link
— creation of a graphical user interface (GUI) for a power systems (with Python and the Qt widget toolkit)
— setting up a demonstration of the simulation platform and comparison with a real system

Industrial collaboration with Typhoon HIL, Cambridge, USA *since 2009*

Typhoon HIL is a technology leader for Hardware-in-the-Loop (HIL) real-time emulators for power electronics

Research internship at ISN, MIT, Cambridge, USA *2009, 7 months*
supervised by Ivan ČELANOVIĆ

Real-time simulation of power electronics circuits
— selection of model structures adapted to the constraints of real-time simulation (1 μs time step)
— creation of a Matlab code for the automatic modeling of power electronics circuits in state space (piecewise linear
dynamical models, also called hybrid systems)

Publications

Energy storage sizing & management for intermittent power sources

— **P. Haessig**, B. Multon, H. Ben Ahmed, S. Lascaud. How important is the choice of the control policy when sizing an energy storage system ? (in French) submitted to *SGE 2014*, Cachan, France, July 2014

— **P. Haessig**, B. Multon, H. Ben Ahmed, S. Lascaud, P. Bondon. Energy storage sizing for wind power : impact of the autocorrelation of day-ahead forecast errors. *Wind Energy*, available online, October 2013

— **P. Haessig**, T. Kovaltchouk, B. Multon, H. Ben Ahmed, S. Lascaud. Computing an optimal control policy for an energy storage. *EuroSciPy 2013*, Brussels, Belgium, August 2013

— **P. Haessig**, B. Multon,H. Ben Ahmed, S. Lascaud, L. Jamy. Aging-aware NaS battery model in a stochastic wind-storage simulation framework. *IEEE PowerTech 2013*, Grenoble, France, June 2013

— B. Multon, J. Aubry, **P. Haessig**, H. Ben Ahmed. Storage systems for electrical energy. (in French) *Technique de l'Ingénieur*, ref BE8100, 2013

Real-time power electronics simulation

— M. Kinsy, D. Majstorovic, **P. Haessig**, J. Poon, N. Celanovic, I. Celanovic, S. Devadas. High-speed real-time digital emulation for hardware-in-the-loop testing of power electronics : A new paradigm in the field of electronic design automation (EDA) for power electronics systems. *PCIM 2011*, Nuremberg, Germany, May 2011.

— J. Poon, **P. Haessig**, J. G. Hwang, I. Celanovic. High-speed hardware-in-the loop platform for rapid prototyping of power electronics systems. *IEEE CITRES*, Waltham, MA, September 2010.

— I. Celanovic, **P. Haessig**, E. Carroll, V. Katic, N. Celanovic. Real-Time Digital Simulation : Enabling Rapid Development of Power Electronics. *Ee 2009*, Novi Sad, Serbia, October 2009.