PhD Proposal 2017

School: Ecole Centrale Nantes	
Laboratory: IRCCyN	**Web site: http://www.irccyn.ec-nantes.fr/fr/**
Team: Control	**Head of the team: F. Plestan et Ph. Chevrel**
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Collaboration with other partner during this PhD: **In France: RTE R&D**	**In China:**

Title: Nonlinear and Nonstationnary Analysis of Inter-Area Power Systems Oscillations
Scientific field: Electrical engineering, Automation and Robotics, System Engineering, Industrial Engineering
Key words: eigencalculation, grid oscillations, nonstationary systems/signals, Hilbert-Huang Transform

Details for the subject:

(Maximal length of 2 pages, including images, list of reference, …The pdf file should not exceed 1Mo)

Background, Context:

Inter-area oscillations are electromechanical swings of large-scale power systems which involve a large number of distant generators [1]. They are *structural* phenomena and thus difficult to investigate on real large-scale power systems. The usual approach for this is based on eigenvectors and eigenvalues which are difficult to compute in large-scale (e.g., [1], [3]). Moreover, this linear analysis depends on the operation point and thus cannot track nonlinear and nonstationary (variation with time) characteristics of these oscillations.

Recent developments like, e.g., [2] propose an alternative to this framework: signals are used instead of a model to extract the oscillations information (frequency and damping of each observable mode). Hilbert-Huang transform allows one to deal with *nonstationnary* oscillations, i.e., with modes of which frequency and damping vary with time (due to grid evolution like load or topology variations).

Research subject, work plan:

This analysis is intended to be exploited for:

- Real-time monitoring of power systems oscillations
- Damping of these oscillation (regulation actions)
- off-line studies to put into evidence dependence on several parameters (load/topology variations)

This work is proposed in a general framework of collaboration with RTE – the French Transmission System Operator – and it is thus connected to real needs of the interconnected power systems. Realistic tests and validations of the theoretic developments mentioned above are possible on grid models and scenarios provided by RTE.

References:

[1] G. Rogers, „Power Systems Oscillations“, Springer 2000.
[2] *Intera-Area Oscillations A Nonlinear and Nonstationnary Perspective*, A. Messina ed, Springer 2009.
[3] B. Marinescu, L. Rouco, A Unified Framework for Nonlinear Dynamic Simulation and Modal Analysis for Control of Large-Scale Power Systems, *Proc. of the 15th Power Systems Computation Conference, Liège (Belgium), August 22-26 2005.*

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