Non-Linear Signals/Grid Frequency Modelling

Bayesian Inference for Deterministic Systems.

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"Given for one instant an intelligence which could comprehend all the forces by which nature is animated and the respective situation of the beings whos compose it–an intelligence suficiently vast to submit these data to analysis–it would embrace in the same formula the movements of the greatest bodies of the universe and those of the lightest atom; for it, nothing would be uncertain and the future, as the past, would be present to its eyes."
P.S. Laplace, circa 1800.

A Philosophical Essay on Probabilities.

Abstract

The first stage of the project involves detailed study of Bayesian techniques for statistical inference. In particular, the study is centred in Markov chain Monte Carlo (MCMC) techniques, that nowadays, are becoming commonly use because offer many new oportunities. In particular we study the performance of this techniques for deterministic chaotic systems.

One "advantage" of this kind of estimation with respect to its counterparts in nonlinear time series analysis is that the former (Bayesian) approach includes information on observational noise in the estimation process "by design"; while the later often separates the estimation process from the noise reduction process. While this separation may bring useful insights into the dynamics, it also introduces both theoretical and philosophical questions about the meaning of the resulting parameters.

This project dicussed what additional care required when analysts from different fields exchange methodologies, but not theoretical interpretations; what do physical parameters mean in an imperfect model class? And how are "climate" forecasts best interpreted?

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