

Invitation

Friday, August 9

Adaptive filtering

Time: 9:00am-4:00pm, Friday, August 9, 2019

Venue: G2-304, 144 Xuan Thuy, Cau Giay, Hanoi

Adaptive filtering and its application to high-dimensional systems

The inverse engineering problems approach is a discipline that is growing very rapidly. The inverse problems we talk about in this lecture concern the way to determine the state and/or parameters of the physical system of interest using observed measurements.

In this context the filtering algorithms like the famous Kalman filter (KF) constitute a key tool to offer improvement of our knowledge on the system state, its forecast... which are essential, in particular, for very high dimensional systems: operational prediction systems in geophysical systems (meteorology, oceanography); image processing; visualizing data; power systems; psychology: children test results (allergens...); finance: study of volatility dynamics; image processing: from eigenfaces to deep learning (identification of human face...); genomics: DNA microarray data;...

Many modern applications fall into the "ultra-high dimension" case with much more variables than observations ($p \ll n$) like operational prediction systems in geophysical systems (meteorology, oceanography, image processing: $n \sim 10^6$; $p \sim 10^5$).

The objective of this lecture is to give an overview on how one can design a simple, no time-consuming Adaptive Filter (AF) to solve the inverse engineering problems with high forecasting performance in very high dimensional environment with uncertainties. Numerous examples will be given to illustrate the AF approach and its comparison, especially with two widely used approaches: Kalman filtering and Variational data assimilation.

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Dr. Hoang Hong Son was born on July 12, 1954 in Vietnam. He has been working for SHOM/LEGOS, Toulouse, France as a researcher and a consultant since 1993. His main researches contain control and filtering in stochastic systems, adaptive filters for very high dimensional systems and dynamical oceanography. He had bachelor degree in Mathematics, Belorussian State University, Minsk, Belarus, 1977 and Ph.D. degree in Applied Mathematics, Polytechnic Institute, Hanoi, Vietnam, 1988. He also was a researcher in Institute Informatics, Hanoi, Vietnam, 1977 - 1979, Institut Defense Technology, Hanoi, 1980 - 1983, Institute Physics, Hanoi, 1984 - 1991. He also was a visiting researcher in LMD/École Normale Supérieure, Paris, 1991 - 1993. Dr. Hong Son Hoang has been listed as a noteworthy mathematician, researcher by Marquis.

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PROGRAM

Morning session (9:00am - 11:30am)

1. Introduction
2. Theoretical background
3. Tools for overcoming uncertainties
(system parameters, model error,...)

Afternoon session (1:30pm - 4:00pm)

4. Tools for overcoming high dimensionalities
(order reduction, stochastic optimization, AI,...)
5. Applications (operational oceanography, electricity)
6. Conclusions and perspectives