國立台灣大學生醫電子與資訊學研究所專題演講 »»

An Adaptive Method for Nonlinear & Nonstationary Data Analysis

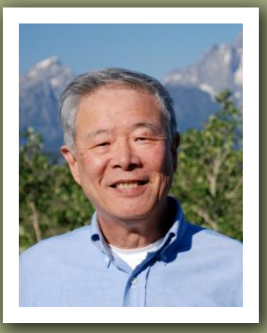
2/20 15:30-17:00

台大校總區 明達館205室

中央大學數據分析方法研究中心

黃鍔 院士

Current Position & Relevant Experience



- Chinese Academy of Engineering. Foreign member, 2007
- Service to America Medal, Science and Environment, 2006
- NASA Medal for Exceptional Technology Achievement, 2005
- 院士，中央研究院 (academician, Academia Sinica), 2004
- Presidential Rank Meritorious Award, 2004
- Member, National Academy of Engineering, 2000

Dr. Norden Huang has lectured extensively in the US, Europe and China; published more than 140 refereed papers on subjects covering the applications of Remote Sensing techniques in physical oceanography, air-sea interaction processes, statistical structure of ocean surface micro-scale phenomena, coastal processes, engineering and biomedical problems; and edited two books on HHT.

Abstract

Data analysis is indispensable to every science and engineering endeavor, but it always plays the second fiddle to the subject area. The reason is that the existing methods of data analysis either the probability theory or the spectral analysis are all developed by mathematicians or based on their rigorous rules. In pursue of the rigorous, we are forced to make idealized assumptions and live in a pseudo-real linear and stationary world. But the world we live in is neither stationary nor linear.

For example, spectral analysis is synonymous with the Fourier based analysis. As Fourier spectrum can only give meaningful interpretation to linear and stationary process, its application to data from nonlinear and nonstationary processes is problematical. And probability distributions can only represent global properties, which imply homogeneity (or stationarity) in the population. As scientific research getting increasingly sophistic, the inadequacy is become glaringly obvious. The only alternative is to break away from these limitations; we should let data speak for themselves so that the results could reveal the full range of consequence of nonlinearity and nonstationarity. To do so, we need new paradigm of data analysis methodology without a priori basis to fully accommodating the variations of the underlying driving mechanisms. That is an adaptive data analysis method, based on the Empirical Mode Decomposition and Hilbert Spectral Analysis. The key is a new definition of frequency, and the result is present in a time-frequency-energy representation. In fact, we can only define true frequency with adaptive method, which would lead to quantify nonstationarity and nonlinearity. Examples from classic nonlinear system and recent climate will be used to illustrate the prowess of the new approach.

歡迎踴躍參加