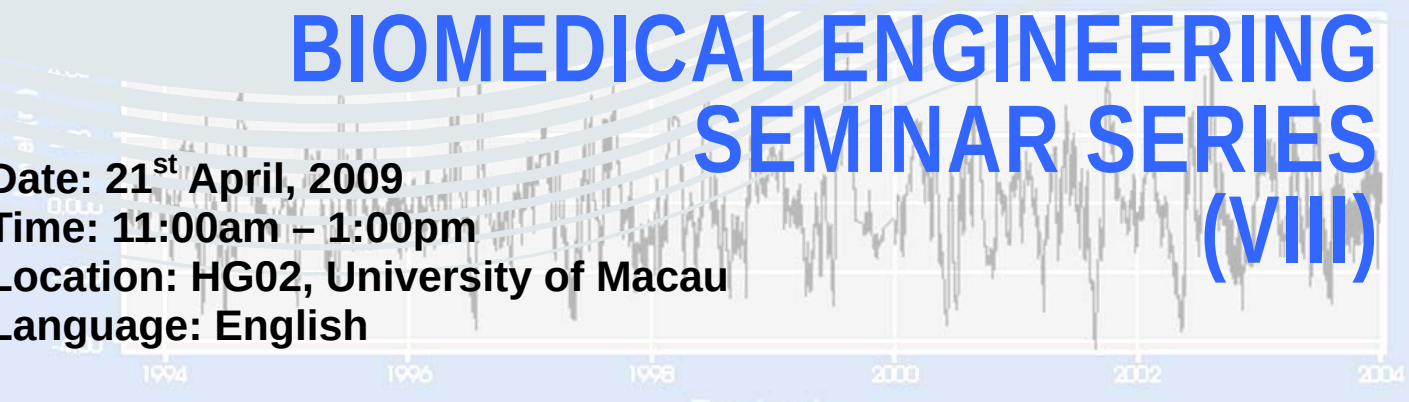
BIOMEDICAL ENGINEERING SEMINAR SERIES (VIII)

Date: 21st April, 2009
Time: 11:00am – 1:00pm
Location: HG02, University of Macau
Language: English



Recent Advances in HHT

By

Prof. Norden E. Huang

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Abstract

Traditionally, the data analysis had been relegated, to a large degree, to 'data processing', where data are routinely put through certain rigid algorithms to extract some mathematically meaningful parameters. Most of the algorithms used in data processing are constructed under very restrict assumptions or developed under the rigorous mathematic rules. This strict adherence to the mathematical rigor often has side effects, as observed by Einstein: "As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality." A more appropriate approach to represent nonlinear and nonstationary data is to have an adaptive basis.

Since its invention over ten years ago, the HHT has been applied to a wide range of applications. The HHT is a two-stage, adaptive method that provides a nonlinear time-frequency analysis that has been remarkably successful in the analysis of signals from nonlinear and nonstationary processes. The fields covered a wide range including (among many others) biology, geophysics, ocean research, radar and medicine. Yet, up to this time, a rigorous mathematical foundation is still lacking. Under this condition, progresses are still empirically based. Some of the recent advances on Ensemble Empirical Mode Decomposition and Instantaneous frequency computation will be discussed. These advances have made the HHT method much more robust.

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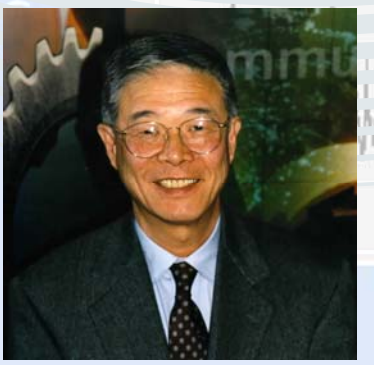

Biography

Prof. Norden Eh Huang, a TSMC Chair Professor and the Director of the Research Center for Adaptive Data Analysis at the National Central University, Taiwan. He held a doctoral degree (1967) in Fluid Mechanics and Mathematics from the Johns Hopkins University. In the past, he has been working on nonlinear random ocean waves. Recently, he has devoted all his time in data analysis, specifically in a new method, the Hilbert-Huang Transform, to process nonstationary and nonlinear time series. Over the last few years, he has applied this method to analyze data in the following areas: nonlinear ocean wave evolution data; earthquake signals and structure responses; bridge and structural health monitoring; biomedical signals such as blood pressure fluctuations; long term environmental data such as global temperature variations, Antarctic ice extents records, and solar irradiance variance; hydro-machinery design and machine vibration data. For this invention, he was awarded the 1998, 2003, 2004 NASA Special Space Act Awards. He was also the winner of the 1999 Federal Government Technical Leadership Award; the 2001 Federal Laboratory Development Award, 2006 Service to America Medal for Science and Environment, and, for his contribution in the filed of nonstationary and nonlinear data analysis, elected as a member of the National Academy of Engineering, 2000.

Dr. Huang serves as an Associate editor for Journal of Physical Oceanography, and Journal of Geophysical Research. He has published extensively on subjects covering data analysis method and its applications to natural science, engineering, biomedical and financial problems.

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