

EXCELLENCE IN TECHNOLOGY TRANSFER

NASA Goddard Space Flight Center

Computer Implemented Empirical Mode Decomposition Method, or, “Hilbert-Huang Transform” (HHT)

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The HHT technology is a highly efficient, adaptive, and user-friendly set of algorithms used to analyze, encode, or modulate signals or data sets for a variety of applications. Dr. Norden Huang developed HHT in 1995 as part of NASA’s ongoing research into ocean waves to advance understanding of Earth science. Huang’s development of HHT was a response to the shortcomings of other alternative methods of signal analysis. Fourier Transform methods (the standard at the time) required that signals be both linear and stationary, making the method unsuitable for many applications in communications, sonar, seismic analysis, acoustics, optics, and medicine that require the analysis of multiple signals that are non-linear and/or non-stationary. When used on such signals, Fourier methods risked low quality and accuracy. Unlike these methods, HHT provides effective analysis of nonlinear and non-stationary signals while also improving the accuracy of linear- and stationary-signal analysis. Since its introduction, the technology has benefited NASA Shuttle safety and testing and has demonstrated broad applicability to research in medicine, the environment, communications, structural and civil engineering, and business.

In July 2004, Goddard entered into a Space Act Agreement (SAA) with Beth Israel Deaconess Medical Center (BIDMC), the goal of which was to refine the use of HHT for a variety of medical research. The result of the agreement is a collaborative effort to enhance monitoring of patients at risk for sudden cardiac failure and stroke, as well as monitor diagnosis and treatment of depression and other neurological disorders. The research was also designed to use HHT to analyze physiological signals in order to measure the vitality of various systems within the body.

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