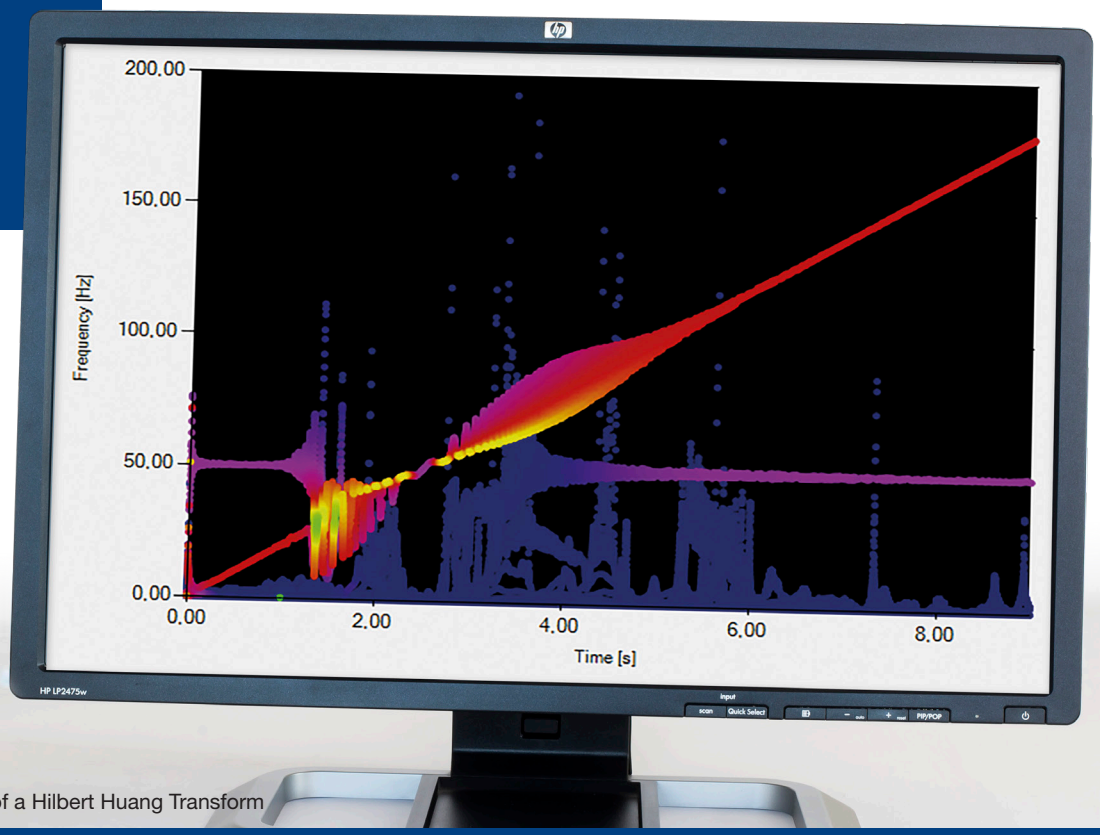

Figure 1: Typical result of a Hilbert Huang Transform

Nonlinear Analysis

Hilbert Huang Transform

The Hilbert Huang Transform[1] (HHT) is part of the new nonlinear signal analysis package for m+p Analyzer. It helps engineers to analyze nonlinear and nonstationary phenomena by performing a time-frequency analysis on an input signal, resulting in a plot of amplitude over frequency and time (Fig. 1).

How It Is Done

The Hilbert Huang Transform was introduced by Huang et al. in 1998 and consists of a two-step process: First the input signal is decomposed into intrinsic mode functions by means of an empirical mode decomposition.

As opposed to classic Fourier analysis, this approach is adaptive, deriving a transformation basis directly from the data. The resulting intrinsic mode functions (example see Fig. 2) each represent a simple oscillatory mode with a variable amplitude and frequency.

These intrinsic mode functions yield more physical meaningful results than classic Fourier analysis when a Hilbert transform is applied in a second step: from each intrinsic mode function, the frequency and amplitude content is extracted and displayed in a plot of amplitude over frequency and time (example see Fig. 1).

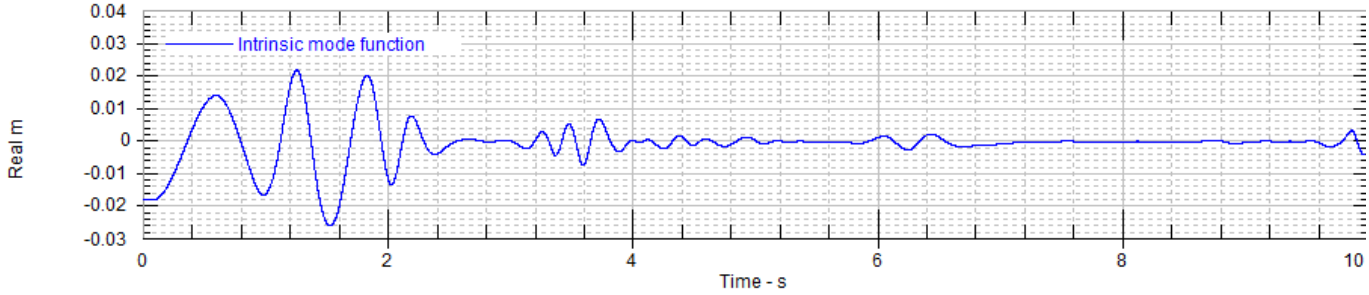

Figure 2: A typical intrinsic mode function: number of zero crossings equals number of extrema, amplitude and frequency vary over time.

[1]Huang, N.E., US Patent 5,983,162, 1999, under public domain

Structural Analysis

m+p Analyzer's structural dynamics package provides a complete set of tools for observing, analyzing and documenting the vibrational behaviour of machines and mechanical structures. Different software modules cover a wide range of techniques including impact testing (SISO, MIMO), shaker measurements, experimental and operational modal analysis, ground vibration testing, modes of vibration animation and modal model validation.

The standard structural dynamics package includes:

- Impact testing using a modal hammer
- Creation of component-based geometries
- Operational Deflection Shape (ODS) analysis and animation

Optional software modules are available to cover the most demanding and advanced modal analysis applications:

- Single Degree of Freedom (SDOF) analysis
- Multiple Degree of Freedom (MDOF) analysis
- Operational Modal Analysis (OMA)
- Modal model validation (MAC, MPD, MPC, MOV, MIF)
- Polyreference Time Domain algorithm (PTD/PolyTime)
- Polyreference Time Domain Plus algorithm (PTD+/ PolyTime+)
- Polyreference Least-Squares Frequency Domain algorithm (p-LSCF/PolyFreq)
- Multiple Input/Multiple Output (MIMO) analysis
- Swept and stepped sine analysis
- Ground Vibration Testing (GVT) with Normal Mode Tuning (NMT)
- Interface to FEMTools for Structural Dynamics Modification (SDM) analysis

m+p international

Founded in Hannover, Germany in 1980, m+p international develops and manufactures test and measurement systems for vibration control, dynamic signal analysis, data acquisition, process monitoring and test stand engineering. Our product reputation and broad experience coupled with valuable user feedback have led to significant market share in numerous key industries worldwide.

The company has its headquarters in Hannover, Germany with sales/marketing subsidiaries in New Jersey (USA), England, France and China, along with representatives and agents in many countries.

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