Approximation and Identification of Control Systems Oscillating Behavior using Wavelet Transform

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As one of the most powerful tools in the signal processing field, wavelet transform (WT) has been used in numerous mathematical as well as engineering applications. Continuous wavelet transform (CWT) decomposes a signal into a time-scale representation that elucidates the transient characteristics of that signal.
The wavelet transform of a continuous signal $f(t)$ is defined as [1]

$$Wf(u,s) = \langle f, \psi_{u,s} \rangle = \int_{-\infty}^{\infty} f(t) \frac{1}{\sqrt{s}} \psi^* \left(\frac{t-u}{s} \right) dt$$

The wavelet coefficients $Wf(u,s)$ defined above represent nothing but a measure for the correlation between the input signal and a dictionary of a translated and dilated versions of the analyzing mother wavelet $\psi(t)$. In order to extract information such as the signal amplitude and/or phase at specific frequency, the wavelet coefficients should be further processed. In this presentation, the usage of wavelet transform in detecting and evaluating residual vibrations in CNC machine tools will be discussed.

References

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