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Discrete Fourier Transform: statistical effect size and significance of Fourier components.

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A key analytical technique in the context of investigating cyclic/periodic features in time-series (and other sequential data) is the Discrete (Fast) Fourier Transform (DFT/FFT). However, assessment of the statistical effect-size and significance of the Fourier components in the DFT/FFT spectrum can be subjective and variable. This presentation will outline an approach and method for the statistical evaluation of the effect-size and significance of individual Fourier components from their DFT/FFT coefficients. The effect size is determined in terms of the proportions of the variance in the time-series that individual components account for. The statistical significance is determined using an hypothesis-test / p-value approach with respect to a null hypothesis that the time-series has no linear dependence on a given frequency (of a Fourier component). This approach also allows spectrograms to be presented in terms of these statistical parameters. The presentation will use sunspot cycles as an illustrative example.