Deriving Full Fourier Power Corresponding to Signal Frequency

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Let sampling frequency .

Let number of data points .

Let positive frequencies

Let signal frequency .

The index of the signal frequency in positive frequencies

Let time series

Then

Discrete Fourier Transform Matrix for performing a Fourier Transform of the vector

Element of Complex Fourier Spectrum corresponding to signal frequency

Full Fourier Power corresponding to signal frequency

Element of Complex Fourier Spectrum corresponding to signal frequency