Title:

Cyclostationarity

Teacher:

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Contents of the Course:

Almost-periodic functions. Characterization of continuous-time cyclostationary and almost-cyclostationary processes in the strict sense. Second-order characterization in the time domain and in the frequency domain. Harmonizable processes. Spectral correlation property. Discrete-time almost-cyclostationary processes. Sampling and aliasing. Linear almost-periodically time varying filtering. Estimation of statistical functions in the time and frequency domains: Mean-square consistency and asymptotic complex normality. Higher-order cyclostationarity. Applications in radar/sonar and communications: Signal detection, synchronization, signal classification. Doppler effect. Generalizations of cyclostationarity: Generalized almost-cyclostationary processes, Spectrally correlated processes, Oscillatory almost-cyclostationary processes. Statistical function estimation. Application to biological signals.

Prerequisites:

Fourier series and transforms; Linear filtering; Uniform sampling; Probability theory; Stochastic processes; Autocorrelation and power spectrum; Signal detection and estimation.

References:

Antonio Napolitano, Cyclostationary Processes and Time Series- Theory, Applications, and Generalizations. Elsevier. 2019.

Antonio Napolitano, Generalizations of Cyclostationary Signal Processing- Spectral Analysis and Applications. Wiley-IEEE Press, 2012.

William A. Gardner, Statistical Spectral Analysis: A Nonprobabilistic Theory. Prentice-Hall, 1987.

Harry L. Hurd and Abolghassem Miamee, Periodically Correlated Random Sequences: Spectral Theory and Practice. John Wiley & Sons. 2007.

A. Napolitano, "Cyclic higher-order statistics: input/output relations for discrete- and continuous-time MIMO linear almost-periodically time-variant systems," Signal Processing, vol. 42, No. 2, pp. 147-166, March 1995. doi: 10.1016/0165-1684(94)00124-I

W. A. Gardner, A. Napolitano, and L. Paura, "Cyclostationarity: Half a century of research," Signal Processing, vol. 86, n. 4, pp. 639-697, April 2006. doi: 10.1016/j.sigpro.2005.06.016

A. Napolitano, "Generalizations of cyclostationarity: A new paradigm for signal processing for mobile communications, radar, and sonar," IEEE Signal Processing Magazine, vol. 30, n. 6, pp. 53-63, November, 2013. doi: 10.1109/MSP.2013.2265101

A. Napolitano, "Cyclostationarity: New trends and applications," Signal Processing, vol. 120, pp. 385-408, March 2016. doi: 10.1016/j.sigpro.2015.09.011

A. Napolitano, "Cyclostationarity: Limits and generalizations," Signal Processing, vol. 120, pp. 323-347, March 2016. doi: 10.1016/j.sigpro.2015.09.013