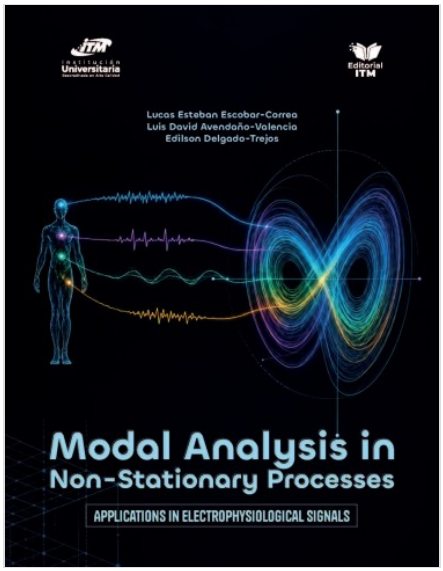
Modal Analysis in Non-Stationary Processes

Applications in Electrophysiological Signals

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Sinopsis

Electrophysiological signals, such as electroencephalography (EEG) signals, are complex by nature, exhibiting non-linear and non-stationary behavior, leading to limitations in their analysis and the development of effective clinical applications. Modal decomposition has proven valuable for studying the dynamic of physiological systems, particularly in disease diagnosis and functional state detection, by decomposing signals into modes that capture essential information. However, existing methods face difficulties with time-varying noise and singularities, such as crossing frequencies and vanishing amplitude components, leading to imprecise applications.The proposed approach in this research book aims to evaluate the EKFs method and two optimized approaches of this technique, using the Metropolis-Hastings Markov Chain Monte Carlo (EKFs−MH) and Expectation-Maximization (EKFs−EM) algorithms, with both a numerically generated non-stationary signal and EEG signals for seizure prediction. The optimized approaches demonstrated superior performance, successfully managing singularities and minimizing errors in state-space representation.

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Palabras clave

Modal analysis; Non-stationary processes; Electrophysiological signals; Eeg; Seizure prediction; Extended kalman filters; Metropolis-hastings; Expectation-maximization; Signal decomposition; Time-varying noise

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