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Covariate-adjusted Sensor and System Outputs for Structural Health Monitoring: A Functional Data Approach

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Structural Health Monitoring (SHM) is increasingly applied in civil engineering. One of its primary purposes is detecting and assessing changes in structure conditions to reduce potential maintenance downtime. Recent advancements, especially in sensor technology, facilitate data measurements, collection, and process automation, leading to large data streams. We propose a function-on-function regression framework for modeling the sensor data and adjusting for confounder-induced variation. Our approach is particularly suited for long-term monitoring when several months or years of training data are available. It combines highly flexible yet interpretable semi-parametric modeling with functional principal component analysis and uses the corresponding out-of-sample phase-II scores for monitoring. The method proposed can also be described as a combination of an “input-output” and an “output-only” method.

Type of presentation

Talk

Classification

Both methodology and application

Keywords

Functional Data Analysis, function-on-function regression, profile monitoring

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