A data-driven feature selection-based procedure for automatic bridge damage localization

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Abstract.

In recent years, advances in Data Science have led to the investigation of various Structural Health Monitoring methods. This study aims to provide an innovative data-driven technique for automatically locating structural damage in bridges based on features extracted from dynamic data. The proposed method utilizes advanced multi-domain and filtering approaches to extract relevant features from sensor data in the temporal, frequency, and quefrency domains. By using a feature selection (FS) procedure, the method reduces redundancy and increases the relevance of the feature set, allowing more accurate damage localization. The pro-posed technique is versatile and can be customized to a specific structure while al-so being generic enough to handle any form, material, or excitation the structure receives. The study also introduces a damage index generated through an outlier analysis using the structure's healthy state as a reference. The proposed procedure has the potential to save time, cost, and resources by reducing the need for manual inspections, accelerating decision-making, and allowing timely maintenance. The methodology is validated in a full-scale bridge under various environmental conditions, such as traffic, temperature, and wind speed changes, showing promising results for real-world monitoring. The study aims to contribute to the ongoing development of efficient and cost-effective structural health monitoring methods in the field of data science.

Keywords: SHM, Feature Selection, Automated, Data-driven, Damage Localization.