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Keynote Paper

Interpretable machine learning paradigm of structural health monitoring

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Safety evaluation and prediction of structures is the goal of structural health monitoring. The vibration-based methodology has been extensively investigated, while the limitation is well-known due to ill-condition of reverse problem (the high level incompleteness and uncertain), coupled effects of damage and environmental actions on modal parameters and insensitivity to damage. The machine learning provides a possible solution to this challenge issue. It is a truth that the performance and conditions of a structure must be embedded in the high-dimensional space of monitoring data. Fortunately, machine learning can help discover and model the performance and conditions of a structure through deep mining of monitoring data by using machine learning as the advanced mathematical frameworks and algorithms, termed the machine learning paradigm for structural health monitoring (SHM). It is noted that the machine learning paradigm for SHM is not only dependent on data, the physics laws, principles and governing equations should be injected into the machine learning paradigm for SHM to improve generalization. This methodology is termed Interpretable/ Physics-informed Machine Learning Paradigm of SHM. This keynote lecture sheds light on principles for Interpretable/ Physics-informed Machine Learning Paradigm of SHM. Some examples are presented to shown the success of this methodology. The existing challenges and open questions in this field are discussed.