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Evidential Reasoning based Digital Twins for Performance Optimization of Complex Systems

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Abstract

Digital twins (DTs) are fast becoming an important technology in manufacturing companies for predicting failures of critical assets. However, such a digital twins is a hybrid representation with multiple parameters which need to be monitored to predict complex phenomena occurring in the asset in real time. This high-fidelity model of the twin makes the computation of the output extensive. Therefore, it is necessary to develop model reduction methods that simplify the high-fidelity model for faster computation with an acceptable degree of error. Such a method was proposed in previous studies to identify important nodes in graph-based DT representation. This article provides an improvement of previous method, considering the uncertainty in important node selection with Dempster-Shafer Theory (DST). The method is demonstrated with a grinding case study.

Keywords: Failure prediction, Dempster-Shafer Theory, Digital Twins, Artificial Intelligence