

ABSTRACT

NEURAL NETWORKS FOR MODEL-BASED PROGNOSTICS

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The increasing demand for performance and durability of advanced aerospace systems has increased the need for health management of these systems. Effective health management involves seamless integration of failure diagnostics, failure prediction, part life estimation, and maintenance logistics. These capabilities have only partially been implemented in current health management systems. Hence the effectiveness of current management systems is compromised.

To achieve the goal of effective prognostic and health management (PHM), promising technologies from various disciplines must be integrated. One of these technologies is artificial neural network (ANN), or neural network (NN). This paper presents a view that NNs have matured in the area of modeling. NN's learning feature is effective in capturing the time-varying, individual behavior of a complex physical system; therefore, NNs can improve the fidelity of the models used onboard aerospace systems to facilitate PHM.

This paper supports the view of NN-based models with a numerical example. The example concerns the modeling of a compressor tip clearance of in a gas turbine engine. The modeling approach blends NNs with the traditional modeling paradigm offering significant advantages. This cooperative approach to modeling also provides a framework for certifying the adaptive portion of the overall model, enabling NN-based algorithms to be implemented in onboard PHM systems. The cooperative approach may also be applied to pattern classification problems.