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FAULT CLASSIFICATION BASED UPON SELF ORGANIZING FEATURE MAPS AND DYNAMIC PRINCIPAL COMPONENT ANALYSIS FOR INERTIAL SENSOR DRIFT

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Abstract. *Fault detection and identification is an active research field in several application areas. There are still many challenges in on-line detection and identification. Over The years several approaches have been pursued based on model-based or knowledge-based techniques, however, these present several practical drawbacks with regards to time consumption or lack of adaptability. Here a mechanism to classify both previously encountered faults and also new novel faults is presented. This is based upon a combination of a statistical approach, Principal Component Analysis (PCA), and non-supervised neural networks, Self Organizing Maps (SOM). Simulation results are presented through insertion of incipient faults into the inertial sensors of an aircraft flight control system and an evaluation of the proposed approach is made.*
Keywords: Fault diagnosis, Neural network, Principal component analysis, Aircraft systems

1. **Introduction.** When the typical faults that occur in a system are known it is possible to devise suitable Fault detection and Isolation (FDI) approaches to detect them. However, it is often the case that all the possible fault categories are not known. This is particularly the case with new systems when they enter into service. In this case a means of detecting and classifying new novel faults is required [21]. Several different approaches can be pursued in order to attain this goal. Techniques based on neural networks [1], Models [20] or statistical models similar to PCA [4] have all been explored at different levels showing interesting results with respect to novel scenarios. In this paper, however, the combination of two techniques based upon DPCA and SOM is proposed. The DPCA results are first used to construct knowledge maps and then these are evaluated through SOM to determine any on-line deviation in the system.