

THE USE OF ARMAX STRATEGY AND SELF ORGANIZING MAPS FOR FEATURE EXTRACTION AND CLASIFICACION FOR FAULT DIAGNOSIS

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ABSTRACT. *Nowadays model-based fault diagnosis is restricted to a-priory knowledge of the plant model where in the case of a model-free strategy, it is necessary to have enough information in terms of the frequency response of the observed plant. This approach presents the advantage of using several strategies for feature extraction and classification to achieve pattern recognition based upon linear or nonlinear strategies. For instance, Principal Component Analysis, wavelets, time frequency distributions and partial model-build parameters (like ARMAX) are techniques feasible to extract key characteristics from data either in terms of time series or clusters. However, these may not be suitable for every data analysis in terms of unknown scenarios; therefore it is necessary to combine some of them to achieve a valid classification. In that respect, the use of non supervised neural networks like ARTMAP or SOM as powerful classifiers to organize the data in accurate terms as post-processing techniques becomes suitable in specific cases, where, the most common characteristics to be found in data are hard nonlinearities and a great variation of frequencies. Based upon these two issues, two strategies are followed; ARMAX (for pre- processing the data) and SOM (for pos-processing the data) both have been chosen in terms of partial linear model representation and the related classification, where, some important restrictions are the related to inherent online characteristics and time variances. This novel strategy is validated by using a heuristic proposal of error measure which is studied and implemented in order to determine the most suitable parameters for this sort of combination from both algorithms. An important issue to be taken into account is sampling to avoid quantization at fault diagnosis algorithm. A benchmark example with two typical faults is reviewed and implemented in order to highlight the benefits of this novel strategy. Results of this evaluation are presented in terms of several simulated experiments considering fault and fault-free scenarios.*

Keywords: Fault diagnosis, Self organizing maps, ARMAX

1. Introduction. Nowadays fault diagnosis is a strategy that can be implemented through several approximations in order to get enough data to discriminate scenarios and isolate faults. Strategies such as unknown input observers, neural networks, self organizing maps, parameter estimation and structural analysis are useful for specific conditions onto system approximation and fault identification. Moreover, the combination of several techniques is expected to be a good approximation for fault isolation like proposed in [8] although it needs a large quantity of data. Several approximations have reviewed this constraint like [9] where function approximation is pursued using a hybrid artificial neural network