

Fault Detection and Identification in Quadrotor System (Quadrotor robot)

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Abstract—Fault Detection and Identification (FDI) monitor, identify, and pinpoint the type and location of system fault in a complex multiple input multiple output (MIMO) non-linear system. A Quadrotor robot is used to represent a complex system in this study. The aim of the research is to construct and design a Fault Detection and Isolation algorithm. This dynamic model is based on the first principles of the Quadrotor: Propeller model and its force as well as moments generation. The Quadrotor controller is designed such that it can be controlled using both the attitude control (inner loop) and position control (outer loop). PD controller used the Phi, Theta, Psi, x, y and z as a reference to adjust the attitude and position of the Quadrotor. The proposed method for the fault identification is a hybrid technique which combined both the Kalman filter and Artificial Neural Network (ANN). Kalman filter recognized data from the system sensors and can indicate the fault of the system in the sensor reading. Error prediction is based on the fault magnitude and the time occurrence of fault. The information will then be fed to Artificial Neural Network (ANN), which consist of a bank of parameter estimation that generates the failure state. This Artificial Neural Network (ANN) is an algorithm that is used to determine the type of fault and the severity level as well as isolate the fault from the system. The ANN is designed based on the back-propagation technique so that it can be trained to generate output based on the data. Based on the result comparison of the residual signal before filter and after filter, the algorithm of FDI is able to identify parts of the system that experience failure and the fault can be solved immediately allowing the Quadrotor to be back to its normal operation. It is also capable to acknowledge the user on the parts of the system which experienced failure and can provide user with the best instructions or solutions for the situation. It is also capable to cater a safe landing.

Keywords— *Kalman filter, Artificial Neural Network, Fault detection, Fault Isolation*