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Online parameter estimation of a miniature unmanned helicopter using neural network techniques

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Abstract

The online aerodynamic parameter estimation of a miniature unmanned helicopter using Neural Network techniques has been presented. The simulation model for the miniature helicopter was developed using the MATLAB/ SIMULINK software tool. Three trim conditions were analyzed: hover flight, 10m/s forward flight and 20m/s forward flight. Radial Basis Function (RBF) online learning was achieved using a moving window algorithm which generated an input-output data set at each time step. RBF network online identification was achieved with good robustness to noise for all flight conditions. However, the presence of atmospheric turbulence and sensor noise had an adverse effect on network size and memory usage. The Delta Method (DM) and the Modified Delta Method (MDM) was investigated for the NN-based online estimation of aerodynamic parameters. An increasing number high confidence estimated parameters could be extracted using the MDM as the helicopter transitioned from hover to forward flight.