Optimal Control of Helicopter Motion

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Abstract— This paper presents an automatic system for the optimal control of helicopters motion. In order to control the linear velocities and the yaw angular rate we introduce 4 supplementary states as the outputs of ideal integrators; these integrates the deviations of the 4 variables (the linear velocities and of the yaw angular rate) from their desired values. To achieve the control, we calculate the gain matrix of the system by concatenation of two matrices: the former is associated to the initial state vector of the system, while the latter corresponds to the supplementary states of the system; the gain matrix of the optimal system will be calculated with respect to the solution of a Riccati algebraic equation. The theoretical results are validated by numerical simulations in the absence or in the presence of wind shears by using complex Matlab/Simulink models and a helicopter motion liniarized model; an optimal control system is designed by using a cost function. The system state has 4 supplementary states in order to control the linear velocities corresponding to the three axes of the body frame and the roll angular rate. The states and command variables history for the designed optimal control system are plotted and the system functionality is proved.