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## Robust adaptive LQR control of nonlinear system application to 3-Dof flight control system (Conference Paper)

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### Abstract

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This paper contains a new proposed regarding on robust adaptive control method merge with Linear-Quadratic Regulator (LQR), to design a faster response controller for uncertain characterized three degree of freedom (3-DOF) flight control module. 3-DOF helicopter is a bench-top module use in laboratory for experimental purposes only. From the previous experiments, it has seen that the transient response of designed PD controller has significantly very large steady state error which is around 50%. For highly uncertain plants it is highly destructive. A 3-DOF flight control system or bench-top helicopter developed by Quanser is intrinsically nonlinear, unstable and totally uncertain because of the nature of three individual angles well-known as pitch, travel and elevation. The target of this proposed control design is to improve the performance of three angles control of 3-DOF helicopter by integration of LQR controller and robust adaptive controller. Usually standard adaptive controller will produce zero steady state error. But for achieving faster response with zero steady state error is quite difficult. Therefore, this paper proposed a robust adaptive with deadbeat algorithm to overcome the limitations. Our proposal is to introduce robustness to parameter uncertainties and disturbances, by using adaptive laws for the plant parameters' uncertainty, as a replacement for the traditional ones. This controller may handle large parameter uncertainties and disturbance with rugged stability. The arbitrary combined optimizing method is engaged in this design to optimize the overall performance of the controller. Simulation results and equations are used to demonstration the effectiveness of the proposed control methodology.


### Author keywords

3DOF helicopter adaptive control linear-quadratic regulator prefilter robust control stability uncertainties

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