OBSERVER BASED DYNAMIC SURFACE CONTROL OF A HYPERSONIC FLIGHT VEHICLE

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Abstract- This paper describes the design and analysis of a proportional integral air speed controller and a nonlinear adaptive dynamic surface altitude controller for the longitudinal dynamics of a generic hypersonic flight vehicle. The uncertain nonlinear functions in the pure feedback flight vehicle model are approximated by using radial basis function neural networks. For the controller design, the complete states are assumed to be available for measurement, then a sliding mode observer is incorporated to estimate the states which are difficult to measure in practice. A detailed stability analysis of the designed altitude controller shows that all the signals of the closed loop system are uniformly ultimately bounded. The robustness and performance of the designed controllers, with and without the observer are verified through numerical simulations of the flight vehicle model for trimmed cruise conditions of 110,000 ft and Mach 15.

Index terms*:* Aircraft, adaptive control, dynamic surface control, neural networks, nonlinear systems, observer.