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Fuzzy Adaptive Non-affine Attitude Tracking Control for a Generic Hypersonic Flight Vehicle

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Abstract

A fuzzy adaptive non-affine attitude tracking control method is proposed for a generic hypersonic flight vehicle (HFV). Due to the complexities of the hypersonic flows and nonlinear dynamics, the aerodynamic coefficients of the HFV are dependent not only on the attack of angle, sideslip angle, angular rates, and Mach number, but also on the deflection angles of the control surfaces. This cause the attitude tracking control problem becomes a non-affine multi-input-multi-output (MIMO) one. By analyzing the characteristics of the aerodynamic coefficients, it can be found that the non-affine terms have a great influence on the attitude dynamics and should not be ignored. Then, a non-affine MIMO attitude tracking controller is designed using fuzzy sliding mode adaptive techniques with consideration of the non-affine nonlinear aerodynamic coefficients. The proposed controller has good practicability because it does not need to know the exact bound values of the uncertain-

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