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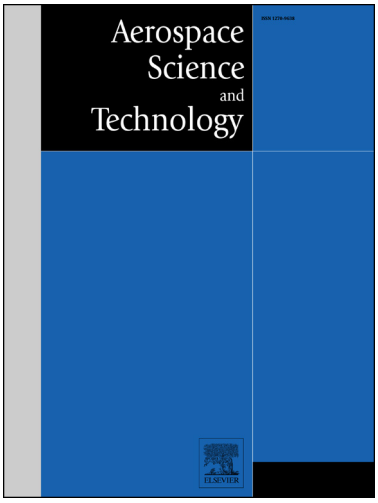

Roll Reversal Phenomenon Control in Flight Vehicles

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Roll Reversal Phenomenon Control in Flight Vehicles

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ABSTRACT:

Roll reversal is one of the most important and challenging phenomena that takes place in some flight vehicles including canard control vehicles. When the roll reversal phenomenon occurs the vehicle rotates in the reverse direction of the roll command. In this situation, the control system will be improper unless this phenomenon can be predicted and accounted for in advance. In this paper, various methods that are used in flight vehicles to mitigate this phenomenon are described. Then, a new control method is developed by using only rate gyro and fin deflection feedback without changing the vehicle aerodynamic configuration. In the proposed method, the negative effect of roll reversal phenomenon is eliminated by using sliding mode control as a robust method taking into account the uncertainty involved in the subject. This control method is on the basis of an online identifier that estimates the roll effectiveness sign and consequently determines the direction of controller command. Finally, this method has been implemented in a six DOF flight simulation that resulted in desirable roll performance in various flight states and therefore verifies the proper performance of this new control method.

Keywords: Nonlinear control, Roll reversal phenomenon, Online identification, Sliding mode control, Flight vehicles.

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