Editor's Note

Near space is of both military and commercial interest. Due to capability of high-speed flying in this area, a reliable and cost-efficient way to access space is presented by hypersonic flight vehicles. Unlike conventional aircraft, hypersonic flight control is challenging, stemming from large flight envelope with extreme range of operation conditions, strong interactions between elastic airframe, the propulsion system and the structural dynamics. In the past decades, robust and adaptive designs have gained increasing attention. To help researchers understand recent progress and new techniques in the topic, this special focus provides one overview article and six research papers.

In the article “*An overview on flight dynamics and control approaches for hypersonic vehicles*”, the authors provide an overview of several commonly studied hypersonic flight dynamics while different schemes such as linearizing at the trim state, input-output linearization, characteristic modeling, and back-stepping are compared. Furthermore, some specific characteristics of hypersonic flight are discussed and the potential future research is addressed.

In the article “*Anti-disturbance control of hypersonic flight vehicles with input saturation using disturbance observer*”, the authors develop a disturbance observer-based terminal sliding mode control scheme for the near space vehicle with unknown disturbance and input saturation to achieve the better tracking performance and the quicker convergence speed of closed-loop system.

In the article “*Composite dynamic surface control of hypersonic flight dynamics using neural networks*”, the authors provide the composite design for the altitude tracking where fast adaptation for uncertainty approximation is achieved and better tracking performance is obtained.

In the article “*Discrete control of longitudinal dynamics for hypersonic flight vehicle using neural networks*”, the authors provide the back-stepping discrete controller based on the Euler expansion of the longitudinal flight dynamics while the minimal-learning-parameter technique is used to reduce the online computation burden.

In the article “*Adaptive control law of mode switching for hypersonic morphing aircraft based on type-2 TSK fuzzy sliding mode control*”, the authors provide the adaptive control law of hypersonic morphing aircraft with retracted winglets where sliding mode control is proposed for different modes and type-2 TSK fuzzy logic system is devised for modeling switching.

In the article “*Neural control of hypersonic flight dynamics with actuator fault and constraint*”, by transforming the attitude dynamics into the “prediction function”, the authors provide the high gain

observer based controller where neural network is used to approximate the lumped uncertainty including the effect of actuator fault and saturation.

In the article “*Super twisting algorithm sliding mode control for a flexible air-breathing hypersonic vehicle based on disturbance observer*”, by writing the flexible air-breathing hypersonic vehicle model into subsystems, the authors provide the robust design with sliding mode control and disturbance observer to deal with system uncertainty. In summary, besides the review paper reporting recent progress in hypersonic flight dynamics and controller design, these six articles cover different aspects of control problems, such as those dealing with system uncertainty, time varying disturbance, actuator dynamics, and those focusing on switching mechanism for morphing aircraft and fast adaption of intelligent learning.

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