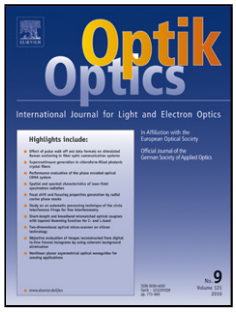

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Integral sliding mode control based approach and landing guidance law with finite-time convergence

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Abstract

In this study, a novel finite-time sliding mode control law is proposed and its application to the approach and landing (A&L) guidance problem is detailed. The proposed control strategy is designed through a combination of integral sliding mode (ISM) concept and polynomial feedback control law. The advantages of this approach are that the robustness is ensured throughout the motion, the convergence time can be chosen in advance and the system states can be expressed in an analytical way. Through the A&L guidance problem, the potential of the developed approach is demonstrated. The guidance scheme can land the reusable launch vehicle at the designated touchdown point with a reasonable amount of vertical velocity. The associated law features in its closed-loop form and the on-line trajectory generation ability. The required information only includes the instantaneous flight conditions and the terminal constraints. Numerical simulations in different scenarios are provided to validate the effectiveness of the proposed method.

Index Terms

Finite-time control, approach and landing, guidance, integral sliding mode, reusable launch vehicle.

I. Introduction

As a subclass of variable structure control, sliding mode control (SMC) is a popular nonlinear deterministic control method tackling the uncertainty and external disturbance under matching

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