Three-dimensional laser beam riding guidance law with finite distance convergence

Junbao Wei¹, Zhong Liu¹, Jijin Tong¹, Haiyan Li¹, and Haidi Dong¹

¹Naval University of Engineering

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Abstract

This paper proposes a three-dimensional laser beam-riding guidance (LBRG) scheme with finite distance convergence for the interception guidance problem of laser beam-riding guided missiles (LBRGMs). First, the motion relationship between the guidance station, missile, and target is constructed, and a three-dimensional LBRG model based on position deviation is designed. Considering the finite range of the laser beam and convergence performance of the guidance system, a finite-distance convergence performance function is proposed, and its guidance law is designed by combining the prescribed performance and sliding mode control methods. Then, considering the unknown maneuvering information of the target, the acquired maneuvering information is converted into an estimation of the line-of-sight angle and its rate, estimated by designing the command filter. In addition, Lyapunov theory is employed to prove the stability of the guidance scheme. The position deviation converged to the steady-state value within the prescribed flight distance, thereby satisfying the prescribed transient and steady-state performance requirements and realizing the interception of the maneuvering target. Finally, the effectiveness of the guidance scheme is verified through simulations.

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