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Prescribed performance interceptor guidance with terminal line of sight angle constraint accounting for missile autopilot lag

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Abstract: A prescribed performance guidance law during the terminal homing phase is proposed to intercept a non-cooperative maneuvering target in this paper. First, on the basis of sliding mode control, a prescribed performance control method based on a revised prescribed performance function is proposed to drive the sliding mode variable to zero. It leads to smooth guidance commands to fulfill the terminal line of sight angle constraint. Then, taking the autopilot's dynamics and its uncertainties into account, a robust controller is designed using dynamic surface control, sliding mode control and inertial delay control, which guarantees the reference guidance commands to be precisely tracked. The highlights of the proposed guidance law are: 1) the transient performance of guidance commands is improved, so that excessive large changes are avoided in the initial phase, 2) parameters that dominant the convergence of the predetermined sliding mode variable can be analytically determined based on the predesigned terminal tolerance, it is more convenient to achieve the prescribed convergence, 3) although uncertainties are existing in the dynamics of missile autopilot, the proposed guidance law could guarantee the terminal interception accuracy. All of the improvements are shown in numerical simulation results.

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