

Trajectory Tracking Control for Quadrotor Helicopter by Controlled Lagrangian Method

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Abstract : A nonlinear trajectory tracking controller for quadrotor helicopter based on controlled Lagrangian (CL) method is proposed in this paper. A Lagrangian system with virtual angles as generated coordinates rather than Euler angles is developed. Based on the model, the matching conditions presented by nonlinear partial differential equations are simplified and explicitly solved. Smooth tracking control laws and the range of control parameters are deduced based on the controlled energy of closed-loop system. Besides, a constraint condition for reference accelerations is deduced to identify the trackable reference trajectories by the proposed controller and to ensure the stability of the closed-loop system. The proposed method in this paper does not rely on the division of the quadrotor system, and the design of the control torques does not depend on the thrust as in backstepping or hierarchical control method. Simulations for a quadrotor model demonstrate the feasibility and efficiency of the theoretical results.

Keywords : quadrotor, trajectory tracking control, controlled lagrangians, underactuated system

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