Title: Stabilization and trajectory tracking control for underactuated quadrotor helicopter subject to wind-gust disturbance

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Abstract: The control of quadrotor helicopter has been a great challenge for control engineers and researchers since quadrotor is an underactuated and a highly unstable nonlinear system. In this paper, the dynamic model of quadrotor has been derived and a so-called robust optimal backstepping control (ROBC) is designed to address its stabilization and trajectory tracking problem in the existence of external disturbances. The robust controller is achieved by incorporating a prior designed optimal backstepping control (OBC) with a switching function. The control law design utilizes the switching function in order to attenuate the effects caused by external disturbances. In order to eliminate the chattering phenomenon, the sign function is replaced by the saturation function. A new heuristic algorithm namely Gravitational Search Algorithm (GSA) has been employed in designing the OBC. The proposed method is evaluated on a quadrotor simulation environment to demonstrate the effectiveness and merits of the theoretical development. Simulation results show that the proposed ROBC scheme can achieve favorable control performances compared to the OBC for autonomous quadrotor helicopter in the presence of external disturbances.