Smooth Second Order Nonsingular Terminal Sliding Mode Control for a 6 DOF Quadrotor UAV

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Abstract : In this article, a nonlinear model of an under actuated six degrees of freedom (6 DOF) quadrotor UAV is derived on the basis of the Newton-Euler formula. The derivation comprises determining equations of the motion of the quadrotor in three dimensions and approximating the actuation forces through the modeling of aerodynamic coefficients and electric motor dynamics. The robust nonlinear control strategy includes a smooth second order non-singular terminal sliding mode control which is applied to stabilizing this model. The control method is on the basis of super twisting algorithm for removing the chattering and producing smooth control signal. Also, nonsingular terminal sliding mode idea is used for introducing a nonlinear sliding variable that guarantees the finite time convergence in sliding phase. Simulation results show that the proposed algorithm is robust against uncertainty or disturbance and guarantees a fast and precise control signal.