Fuzzy Based Backstepping Control Design for Stabilizing an Underactuated Quadrotor Craft under Unmodelled Dynamic Factors

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Since the quadrotor unmanned aerial vehicle (UAV) is one of the systems that has four (4) control inputs and six (6) degree of freedom (DOF) which makes it as an under actuated system. Such under actuated mechatronic systems are very difficult to stabilize but at the same time these systems are power efficient and cost-effective because of a lower number of actuators. Later, if someone tries to stabilize this under actuated quadrotor UAV under the impact of unmodelled dynamic factors, it will lead to huge instability, low convergence rate, chattering effect, trajectory deviation and may also encounter some of the serious transient and steady state issues as well. This paper presents one of the adaptive-robust control algorithms, called the fuzzy based backstepping control (FBSC) design, to address the quadrotor's helical trajectory tracking issue under an influence of unmodelled dynamic factors and external disturbances. This manuscript proposes the synthesis of the proposed FBSC design using MATLAB and Simulink software whereas these results are correlated with the conventional backstepping control (BSC) algorithm to show the effectiveness of the proposed algorithm by computing the integral absolute error values with and without disturbances.

Keywords:

Under actuated quadrotor UAV; Unmodelled dynamics; Chattering effect; Fuzzy based backstepping and helical trajectory tracking

Biography:

Engr. Ghulam E Mustafa Abro is one of the active members at Institute of Electrical and Electronic engineers Inc. (IEEE) and currently working as graduate research assistant at Institute of Autonomous Systems (IAS) particularly at research group of "Center of System Engineering CSE" at Universiti Teknologi PETRONAS, Malaysia. In addition to this, Mr. Abro has authored more than 20+ Internationally recognized publications which include computer vision and control, Internet of robotic things, Modelling and designing control systems for the stabilization of underactuated systems under the influence of unmodelled dynamic factors. He is also recipient of three (3) national grants awarded by Higher Education Commission (HEC) Government of Pakistan and one International grant awarded by Institute of Electrical and Electronic Engineers Inc. (IEEE).

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