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Author: Dr. Raja Munusamy
University of Petroleum and Energy Studies, India, rajavionics@gmail.com

Dr. Ugur Guven
UN CSSTEAP, United States, drguven@live.com
Mr. Kartikay Singh
University of Petroleum and Energy Studies, India, kartikaysingh1297@gmail.com
Ms. Aishwerya Singh Gahlot
University of Petroleum and Energy Studies, India, aishwerya1@gmail.com
Mr. Ayush Gupta
University of Petroleum and Energy Studies, India, ayush15499@gmail.com

DESIGN AND DEVELOPMENT OF ATTITUDE CONTROLLED SYSTEMS USING ADAPTIVE NEURAL NETWORKS

Abstract

In this paper we present novel three-axis attitude control algorithms for small satellites using magnetic torquers and adaptive neural networks to investigate their performance through simulations. The paper can be considered as a comparative study between the traditional and non-traditional methods. Traditional method employ PID tuning which if tuned optimally, the device tends to minimize deviation from the set point, and are expected to responds to disturbances or set point changes quickly but with minimal overshoot. However, manual tuning of these controllers is tedious and often leads to poor performance. The conventional Ziegler-Nichols (Z-N) method of PID tuning was done experimentally enables easy identification stable PID parameters in a short time, but is accompanied by overshoot, high steady-state error, and large rise time. The integrated architecture in this paper aims to combines feed forward control and error feedback adaptive control using neural networks. The paper is expected to reveal the different internal functionality of these two kinds of neural network controllers for certain input styles, e.g., state feedback and error feedback. With error feedback, neural network controllers learn the slopes or the gains with respect to the error feedback, producing an error driven adaptive control systems and with state feedback the system keeps trying to approximate a stable approach in order to stabilize the attitude of the satellite.