Proceedings of the 34th Annual Mechanisms and Robotics Conference
MR-34 August 15-18, 2010, Montreal, Quebec, Canada

DETC2010-28239

CONTROL OF A PNEUMATIC GANTRY ROBOT WITH ADAPTIVE NEURAL NETWORK COMPENSATION

Sasan Taghizadeh
Dept. of Mechanical and Materials Engineering
Queen's University, Kingston, Ontario
K7L 3N6, Canada
taghizadeh@appsci.queensu.ca

Brian Surgenor
Dept. of Mechanical and Materials Engineering
Queen's University, Kingston, Ontario
K7L 3N6, Canada
surgenor@me.queensu.ca

Mohammed Abu-Mallouh
Dept. of Mechatronics Engineering
Hashemite University, Zarqa, Jordan
13115
mmallouh@hu.edu.jo

ABSTRACT

In a previous paper, the application of a pneumatic gantry robot to contour tracking was examined. A hybrid controller was structured to control the contact force and the tangential velocity, simultaneously. Performance was found to be limited by system lag and Coulomb friction. A neural network (NN) compensator was subsequently developed to counter both effects. Simulation results for straight and curved edge workpieces demonstrated the effectiveness of the NN compensator. This paper validates the results experimentally, highlights the tuning issues associated with an adaptive NN compensator, and confirms the capabilities of a pneumatic gantry robot.

non-model based controllers, the latter avoids problems due to model uncertainties. Neural networks (NNs) provide one approach to non-model based control.

Success has been reported with the use of NNs for the compensation of system nonlinearity, including lag [5]. Some of this work has been for applications with pneumatic actuation. For example, Gi et al in [6] studied a feedback linearization by means of a NN toolbox for position control of a pneumatic actuator. The NN was trained off-line. Experimental results showed that the NN improved tracking performance relative to a non-compensated controller for a range of reference signal frequencies and amplitudes.