NEURO-FUZZY CONTROLLER FOR A XY POSITIONING TABLE

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ABSTRACT—This paper presents control designs using an neuro-fuzzy network (NFN) for a XY positioning table. The neuro-fuzzy controller is composed of an outer PD tracking loop for stabilization of the fast flexible mode dynamics and an NFN inner loop used to compensate for the system nonlinearities. A tuning algorithm is given for the NFN parameters so that the NFN control scheme becomes adaptive, guaranteeing small tracking errors and bounded weight estimates. Formal nonlinear stability proofs are given to show that the tracking error is small. The proposed neuro-fuzzy controller is implemented and tested on an IBM PC-based XY positioning table, and is applicable to many precision XY tables. The algorithm, simulation, and experimental results are described. The experimental results are shown to be superior to those of conventional control.