Recurrent neural fuzzy network for high-precision motion control of PMLSM drives

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ABSTRACT

This thesis proposes a recurrent neural fuzzy network (RNFN) for the high-precision motion control of permanent magnet linear synchronous motor (PMLSM) drives. The RNFN Control system consists of two network structures; namely, RNFN identifier (RNFI) and RNFN Controller (RNFC). The RNFI is first trained to capture the inverse dynamics of the PMLSM drive and then is used as a feedforward controller to calculate the desired control force of the PMLSM along a desired trajectory; while RNFC is used as an error-feedback Compensator to minimize the trajectory tracking error resulted from system uncertainties. Structure and Parameter learning algorithms are concurrently preformed is RNFN online. A recursive recurrent learning algorithm based on the gradient descent method is derived for the parameter learning. An analytical method based on a discrete-type Lyapunov function is proposed to guarantee the convergence of RNFN by choosing varied rates. The experimental setup is comprised by a host computer, a servo controller board, a motor driver and a PMLSM. Simulation sand experiments performed on a PMLSM drive demonstrate the effectiveness off the proposed control system.

Keywords : Recurrent neural fuzzy network、Linear synchronous motor、Network convergence theorem

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