Neural Network and fuzzy control in FES-assisted locomotion for the hemiplegic

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摘要

Abstract

This study is aimed at establishing a neural network and fuzzy feedback control FES system used for adjusting the optimum electrical stimulating current to control the motion of an ankle joint. The proposed method further improves the drop-foot problem existing in hemiplegia patients. The proposed system includes both hardware and software. The hardware system determines the patient's ankle joint angle using a position sensor located in the patient's affected side. This sensor stimulates the tibialis anterior with an electrical stimulator that induces the dorsiflexion action and achieves the ideal ankle joint trace motion. The software system estimates the stimulating current using a neural network. The fuzzy controller solves the nonlinear problem by compensating the motion trace errors between the neural network control and actual system. The control qualities of various controllers for four subjects were compared in the clinical test. It was found that both the root mean square error and the mean error were minimal when using the neural network and fuzzy controller. The drop-foot problem in hemiplegic's locomotion was effectively improved by incorporating the neural network and fuzzy controller with the functional electrical simulator.