

ABSTRACT

Nonlinear Process Control Using Neuro Fuzzy Linear Quadratic Regulator

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The quality and productivity of industrial processes can be greatly improved if their supervisory controllers are optimal. There are several challenges to achieving automated optimal supervisory control which include unknown models of the overall system, or the process models if known are often nonlinear, complex and high order. Control of complex high order systems demand significant memory and involve a large number of computations.

This thesis presents a neuro fuzzy technique based on sparse tensor storage that is effective in modeling systems of low to high order called the Sparse Distributed Neuro Fuzzy architecture (SDNF). The SDNF architecture is also shown to be effective in achieving automated optimal supervisory control. The development, simulation and testing of the architecture done using Matlab. The results show that the SDNF architecture can adequately model process models of high order while being efficient in memory and the number of computations. The SDNF architecture was combined with the classical LQR technique to demonstrate how optimal control of complex, high order problems can be achieved using neuro fuzzy techniques.

Keywords: Anthony Doodnath; tensors; fuzzy systems; neuro fuzzy techniques; neuro control; sparse distributed neuro fuzzy architecture; soft computing; Venice lagoon; aircraft pitch control; blood glucose control; LQR; Mackey-Glass; exchange rate