URN etd-0407109-183707-497
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Statistics This thesis had been viewed 40 times. Download 23 times.
Department
Year 2005
Semester 2
Degree Master
Type of Document Master's Thesis
Language zh-TW.Big5 Chinese
Title On-line Tuning EWMA Controllers Utilizing Neural Network Approach
Date of Defense 0000-00-00
Page Count 61

Keyword
EWMA
Discount factor
Drift speed
Neural network
IMA
ACF
PACF

Abstract
In the semiconductor manufacturing, Exponentially Weighted Moving Average (EWMA) controller has been shown to be an effective feedback control system. The performance of the EWMA controller depends heavily on the weight parameter (also called “discount factor”) of the system. According to the realization of the literature, using adaptive discount factors provides EWMA controllers that are superior to those using fixed discount factors. The reason is that shift or drift often exists in the semiconductor manufacturing, resulting in a process with unexpected bias and variance. Therefore, on-line adjusting the discount factors is a necessary task. Therefore, this research focuses on the study of dynamical EWMA controllers, especially those based on the neural network technique (NN). Traditionally, choosing discount factor dynamically needs complicated mathematical derivation. Applying neural network technique to on-line tune the discount factors, on the other hand, can avoid such complication. Several EWMA controllers based on NN have been proposed in the recent literature. Nonetheless, there has not been a systematic study in comparing the efficiency and robustness of these controllers. ◦
In this research, a Monte Carlo simulation work is carried out to evaluate and compare the efficiency and robustness of the existing NN based EWMA controllers under the IMA(1,1) disturbance process model. This thesis mainly considers two types of NN EWMA controllers, one with process variance and drift speed estimates and the other with sample autocorrelation function (SACF) and sample partial autocorrelation function (SPACF) of the process outputs as NN input factors. There are several results found in this thesis. (1) For process with IMA(1,1) disturbance, utilizing the pattern of SACF as the NN input is already enough to control the process. (2) With the necessity of entering both SACF and SPACF patterns into an NN system, one must find a suitable way to pair two patterns together (by lag). (3) The parsimonious of the NN system should be considered carefully. (4) Process variance and drift speed have shown to be two key input factors of the NN system for determining the discount factor of the controller, a method of combining them with SACF and/or SPACF as NN inputs shall be developed in our future research. Our results provide guidelines not only for choosing a suitable controller, but also for enhancing an NN based controller.
Advisory Committee Huey Yan - advisor

Files etd-0407109-183707-497-001.pdf

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Date of Submission 2006-07-19