International Conference
on Industrial Engineering and Systems Management

IESM' 2009

May 13 - 15, 2009

MONTREAL - CANADA

Reduction of Product Driven System emulation models based on neural network: impact of discrete data*

Philippe THOMAS, André THOMAS, Marie-Christine SUHNER

Centre de Recherche en Automatique de Nancy (CRAN-UMR 7039),

Nancy-University, CNRS

ENSTIB 27 rue du Merle Blanc, B.P. 1041

88051 Epinal cedex 9 France

Abstract

Product Driven Systems (PDS) architecture needs emulation systems [13]. Discrete events simulation is then often used to build this emulation tool, but emulation model design is not a trivial task. Also, the goal of this paper is the study of the design of a simulation model by reducing its complexity. According to theory of constraints, we want to build reduced models composed exclusively by bottlenecks and a neural network. Particularly a multilayer perceptron, is used. The structure of the network is determined by using a pruning procedure. This work focuses on the impact of discrete data on the results. This approach is applied to sawmill internal supply chain.

Key words: multilayer perceptron, reduced model, simulation, neural network, re-scheduling, supply chain

1 Introduction

In Manufacturing, Planning and Control processes (centralized way to control physical flow in a Supply Chain), evaluation of planning or scheduling scenario by simulation is very useful for the decision makers. Indeed, simulation highlights the evolution of the machines states, the WIP (work in process), and the queues. This information is useful in order to perform a "Predictive scheduling" [8] or a rescheduling. On the other hand, in Product Driven processes (distributed way to control physical flow in a Supply Chain) dedicated architectures are implemented. These architectures consist of a control system and an emulation system. The last one is very useful for PDS design and validation and for control scenario evaluation. So, the PDS architectures require the use of emulation models which are sufficiently precise for representing correctly the system while remaining simple in order to decrease computing times. Discrete event simulation is also often used to build this emulation system, but emulation model design, which is not a trivial task, relies on reusability, modularity and genericity concepts [13]. At these levels of planning and control and to estimate how the whole physical system works, the "management of critical resources" (bottlenecks) is often pertinent [16]. Goldratt and Cox, in "The Goal" [6] put forward the Theory of Constraints (TOC), which proposes to manage the whole supply chain by bottlenecks

* This paper was not presented at any other revue. Corresponding author P. Thomas. Tel. +33(0) 3 29 29 61 73. Fax +33(0) 3 83 68 44 37

Email addresses: philippe.thomas@cran.uhp-nancy.fr (Philippe Thomas), andre.thomas@cran.uhp-nancy.fr (André Thomas), marie-christine.suhner@cran.uhp-nancy.fr (Marie-Christine Suhner).