

# MANUFACTURING ARCHITECTURE DESIGN USING DISCRETE MATERIAL FLOW MANAGEMENT

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## Abstract

The main problem treated in this paper is that if we want to optimize a network of manufacturing systems design using discrete material flow management we need a new algorithm different from the one used for a single manufacturing system. For a single manufacturing system we usually use discrete material flow simulation to identify and eliminate bottlenecks where the flow is slowed down or blocked in order to increase the productivity. For a network of manufacturing systems material flow concentrators could be the bottlenecks found in one of the manufacturing systems using this classical discrete material flow simulation but it also could be a new different one. We focus in this paper on the algorithm we propose to solve this problem of identifying and eliminating not the bottlenecks of each manufacturing system but of the entire network. A case study of multipolar synchronous simulation (as we named our proposed algorithm) is presented in order to illustrate across a tree nodes manufacturing network how this new algorithm works.

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**Key Words:** Simulation, Virtual Enterprise, Discrete Material Flow, Manufacturing Systems, Productivity.

## 1. INTRODUCTION

We define diffused manufacturing systems as architectures with more than two work points connected by transport & transfer systems and using deposits at local or system level. We define then concentrate manufacturing systems as architectures based on a single work point surrounded & assisted by transport, transfer & deposit facilities [1]. Diffused as well as concentrated manufacturing systems could be mass production, batch production and job shops [2]. We agree here with the thesis that within the class of stochastic simulation models, one further distinction is necessary: simulations can be either terminating (sometimes called finite) or nonterminating in nature, with specific algorithms for each category [3].

We consider a material flow and process synchronous simulation the simulation of a model where at the level at the work point the process simulation is concomitant with the material flow simulation [4]. We define as multipolar synchronous simulation the integrated monitoring system of more than two material flow simulations interconnected in an enterprise network architecture [5]. We agree that virtual enterprises (VE) could be defined as a network of enterprises collaborating to produce a single product during a project cycle time [6]. In VE manufacturing design optimization, the simulation of the system material flow must succeed to CAD (computer aided design), CAE (computer aided engineering) and CAM (computer aided manufacturing) analyses [7]. For a designed manufacturing architecture it is always useful to simulate the material flow conduct before applying our design into practice in order to avoid potential flow concentrators (bottlenecks) generating low productivity or even

multipolar model is synchronizing the results of material flow and process simulation models for all the nodes of the virtual enterprise architecture the isolated FMS simulations acting like elements of the multipolar model (workpoint, buffers, etc.).

If we want to optimise virtual enterprise integrated behaviour it's not enough to run a discrete material flow simulation. The discrete material flow management is just one of the main integrated management systems for a virtual enterprise [12]. However the multipolar simulation, based on the model done using an SADT algorithm is very useful in order to optimize the manufacturing design of the VE architecture.

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