

Chapter 16

CP-BASED DECISION SUPPORT FOR PROJECT DRIVEN MANUFACTURING

Zbigniew A. Banaszak

Faculty of Electronics and Computer Science, Technical University of Koszalin, Sniadeckich 2,75-453 Koszalin, Poland

banaszak@tu.koszalin.pl

Abstract

Some of the most challenging issues that arise in the domain of distributed manufacturing technology and management include manufacturability analysis, validation and evaluation of process plans, partnership in virtual enterprises, process design, and optimization of production plans and schedules. These issues are easily unified within a framework of a project-driven manufacturing concept which is focusing on small and medium size enterprises (SMEs) where products are manufactured based on make-to-order or build-to-order principle.

Regardless of character and scope of business activities a modern enterprise, has to build a project-driven development strategy in order to respond to challenges imposed by growing complexity and globalization. Managers need to be able to utilize a modern decision support tools as to undertake optimal business decisions in further strategic perspective of enterprise operation. In this context this contribution covers various issues of project management engineering while focusing in the field of Project-Driven Manufacturing, particularly in domains regarding the development of novel constraint programming based mathematical models and related decision-making methods as well as their implementation into the task oriented decision support systems aimed at project-driven SMEs management.

Keywords:

Decision support, constraint logic programming, production planning, modeling, scheduling

16.1 Introduction

The key factor for companies confronting the challenge of remaining competitive in an era of globalization is undoubtedly the capability to fast and accurate decision making, especially in project management domain. Currently, the field of project-oriented management of manufacturing systems is driven primarily

by market forces. Some of the most challenging issues that arise in the domain of distributed manufacturing technology and management include manufacturability analysis, validation and evaluation of process plans, partnership in extended enterprises, process design, and optimization of production plans and schedules. These issues are easily unified within a framework of a project-driven manufacturing concept which is focusing on small and medium size enterprises (SMEs) where products are manufactured based on make-to-order or build-to-order principle (see Kis et al (2004)).

In that context our objective is to provide a constraint programming based methodology aimed at designing of task oriented decision support systems (DSS) in particular oriented to the project management tasks in SMEs. Two purposes are considered. Firstly, to contribute to the problem of DSS designing by providing a new modeling framework unifying a customer-producer model and the state space pruning strategies as well as programming languages available. Secondly, to present the possible implementations of the programming methodology provided, i.e., showing a way enabling searching strategy evaluation, searching for adjustment of programming consistency (including problem statement and its specification, implemented constraint programming language, and the searching strategy applied), and showing an illustrative example of a software package application to a production order evaluation in the SME.

16.1.1 Multi-project environment

Finding an answer to the question whether a given production order can be accepted to be processed in a SME seems to be a fundamental from the customer-driven, and highly competitive market point of view. In order to decide whether a new production order (i.e., a new project) can be executed in a given production system, the producer capabilities and the customer needs have to be taken into account. So, the question facing a decision maker is whether the consumer's requirements can be balanced with the producer's capability (see Figure 16.1).

In that context decision making regards to the question whether enterprise's capability allows to fulfill constraints imposed by the production order requirements, i.e. whether its completion time, batch size, and its delivery period satisfy the customer requirements while satisfying constraints imposed by the enterprise configuration taking into account available resources, know how, experience, and so on. In the case of the response to this question being positive, i.e. there exist a way guaranteeing to complete a production order, the next question regards of finding of the most efficient one (e.g. as to be competitive on the market) (see Banaszak et al (2005), Banaszak and Zaremba (2004a), Banaszak (2003)).