

## **A Brief Survey of Just-In-Time Sequencing for Mixed-Model Systems**

**Tanka Nath Dhamala\* and Wieslaw Kubiak**

Faculty of Business Administration, Memorial University of Newfoundland A1B 3X5, St. John's,  
Newfoundland, Canada

---

**Abstract**—The concept of penalizing jobs both for being tardy and for being early has proven one of most important and fertile research topics in Operations Research. In this survey, we consider just-in-time mixed-model, multi-level supply chains. Obtaining an optimal sequence in a multi-level chain is a challenging nonlinear integer programming problem. Problems for two or more levels are strongly NP-hard. The problem of minimizing deviations between actual and desired production for single-level can be solved efficiently. Also the multi-level problems with pegging assumption are solvable by reducing them to the single-level. Cyclic schedules are optimal for single-level problem. We present various ways of dealing with these problems such as the elegant concept of balanced words and different optimization techniques. We provide a short review of different mathematical models, discuss their complexity and compare them. The research results obtained in past several years are presented along with open problems and possible extensions.

**Keywords**—Nonlinear integer programming, Scheduling theory, Just-in-time systems, Balanced (level) schedules, Balanced words, Computational complexity, Polynomial algorithms

---

---

\* Corresponding author's e-mail: dhamala@yahoo.com