

---

# Dynamic Production Planning in Unreliable Reconfigurable Manufacturing Systems

Houcine Dammak<sup>\*†1</sup>, Adnène Hajji<sup>‡1</sup>, and Mustapha Nour El Fath<sup>§1</sup>

<sup>1</sup>Laboratoire CIRRELT Université Laval Québec (CIRRELT) – Université Laval Pavillon Palasis-Prince, bureau 2642 2325, rue de la Terrasse Québec (Québec) G1V 0A6 CANADA, Canada

## Résumé

This paper is intended to deal with a dynamic production planning problem for unreliable Reconfigurable Manufacturing Systems (RMS). The considered system is composed of an industrial facility subject to random failures and producing a product family intended to a given market with random demand. The market demand varies in term of product type and demand rate. To face the three sources of uncertainty (failures, product type and demand rate) the manufacturing facility is designed to be reconfigurable. Within the class of RMS the considered system is designed to change its structure quickly in order to adjust its production capability in term of capacity and product type to produce. Given the significant compromise between reconfiguration, production, inventory and shortage costs, this paper main objective aims to propose a feedback adaptive strategy which provides a better control of the reconfiguration sequence and the production rate of the system that minimises a cost function. A dynamic programming formulation of the problem is presented. Then, a numerical schema is adopted to solve the obtained optimality conditions. Under the hedging point policies (HPP) class, a configuration dependent HPP is proposed. The results show a significant gain in term of incurred costs compared to those incurred when the reconfiguration decision are developed independently of the production planning decisions. Several sensitivity analysis are conducted to illustrate the robustness and effectiveness of the proposed policies. To address the problem in more complex reconfigurable situations a simulation based approach is also proposed and implemented. The application of this approach allowed us to extend the aforementioned findings to different contexts where the mathematical resolution approach may be limited.

**Mots-Clés:** dynamic programming, hedging policies, production control, reconfigurable manufacturing systems, simulation.

---

<sup>\*</sup>Intervenant

<sup>†</sup>Auteur correspondant: Houcine.Dammak@cirrelt.ca

<sup>‡</sup>Auteur correspondant: adnene.hajji@fsa.ulaval.ca

<sup>§</sup>Auteur correspondant: mustapha.nourelfath@gmc.ulaval.ca