

Dynamic Layout Problem study using genetic algorithm taking variable demand and product mix into account .

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Abstract

This study aims to evaluate the efficiency and meaningfulness of the presented model as well as defining a method to tackle the Dynamic Facility Layout problem. In order to achieve such goals different approaches found in the literature were combined resulting in a mathematical model which uses discrete representation for the equipments' positions .

Key words:

Reconfigurable Layout; Genetic Algorithm; Dynamic Layout;

Introduction

The *Dynamic Facility Layout Problem* or DFLP, is a trending topic due to the increasing need for production flexibility (MENG *et. al.*, 2004)¹, and such production requirements have been motivating many different study and analyses models of the DFLP (PIERREVAL, 2003)².

This study proposes an experimental study thoughtout an adapted model from Balakrishnan *et. al.* (1992)³, the first differs from the latter as it takes into account the product mix as well as a defined function that determines the re-layout cost.

The re-layout cost is calculated as cost per distance unit constant proportional to the distance between the two locations where the equipment is in a certain time period and will be in the one that follows.

The model discussed is shown in equations 1, 2, 3 and 4.

$$F(x) = \text{mim} \left[\sum_{t=2}^T \sum_{i=1}^N \sum_{j=1}^N \sum_{l=1}^N a * d_{jl} * x_{(t-1)ij} * x_{til} + \sum_{t=1}^T \sum_{p=1}^N \sum_{k=1}^N \sum_{i=1}^N \sum_{j=1}^N \sum_{k=1}^N \sum_{l=1}^N D_{tp} * f_{ptik} * d_{jl} * x_{tij} * x_{tkl} \right] \quad (1)$$

Subject to:

$$\sum_{t=1}^T \sum_{i=1}^N x_{tij} = 1 \quad t = 1,2 \dots, T \quad i = 1,2 \dots, N \quad (2)$$

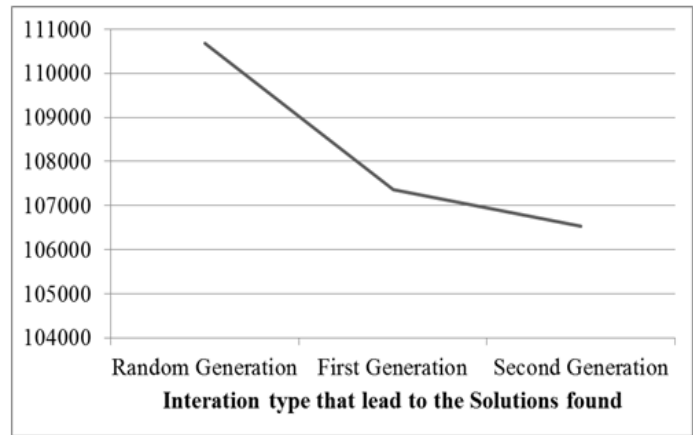
$$\sum_{t=1}^T \sum_{j=1}^N x_{tij} = 1 \quad t = 1,2 \dots, T \quad j = 1,2 \dots, N \quad (3)$$

$$x_{tij} \in \{0,1\} \forall t, i, j \quad (4)$$

Results and Discussion

The model was used for solving an experimental problem using genetic algorithm. The cost optimization processing through the algorithm's solving phases is shown at chart 1 below.

Chart 1 - Average Solution per Interaction



Conclusions

The results obtained managed to prove the efficiency of the usage of genetic algorithms for solving DFLP as satisfactory solutions could be found with relatively low computer processing time, thus cost.

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¹MENG, G.; HERAGU, S. S.; ZIJM, H. **Reconfigurable layout problem.** International Journal of Production Research, v. 42, n. 22, 2004

²PIERREVAL, H.; CAUX, C.; PARIS, J. C. ; VIGUIER, F. **Evolutionary approaches to the design and organization of manufacturing systems.** Computers & Industrial Engineering, v. 44, n. 3, 2003.

³BALAKRISHNAN, J.; JACOBS, F. R.; VENKATARAMANAN, M. A. **Solutions for the constrained dynamic facility layout problem.** European Journal of Operational Research, v. 57, n. 2, 1992.