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


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 thought out 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.

\[ F(x) = \text{min} \left[ \sum_{t=1}^{T} \sum_{j=1}^{N} \sum_{i=1}^{N} \alpha \cdot d_{ij} \cdot x_{(t-1)ij} \cdot x_{tid} \right. \]
\[ \left. + \sum_{r=1}^{T} \sum_{p=1}^{N} \sum_{r=1}^{N} \sum_{k=1}^{N} \sum_{l=1}^{N} D_{rpl} \cdot f_{petlk} \cdot d_{ij} \cdot x_{etij} \cdot x_{etkl} \right] \]

Subject to:
\[ \sum_{t=1}^{T} \sum_{j=1}^{N} x_{tji} = 1 \quad t = 1, 2, ..., T \quad \sum_{j=1}^{N} x_{tij} = 1 \quad t = 1, 2, ..., T \quad j = 1, 2, ..., N \]
\[ x_{tij} \in \{0, 1\} \quad \forall t, i, j \]

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.

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.

Acknowledgement
This research was made possible by SAE’s scholarship as well as the support from Unicamp’s LEGOS research group.