Multi-Criterion Multi-Product/ Machine Assignment Problem in Industrial Factories

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AUTHORIZATION FORM

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This humble work is dedicated to my family, teachers, and friends. And to everyone who would need this work to refer to in his/her studying journey.
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ABSTRACT

Multi-criterion Assignment of Multi-product/machine Problem in Industrial Factories

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The problem of products-to-machines assignment (PMA) is an important concern in industrial factories, and may have a significant impact on the overall cost of the operations. In spite of the problem complications, a primarily approach is to consider suitable product-machine assignment. The importance of solving such a multi-products multi-machine assignment problem increases as the size of the production facility increase; as the problem becomes more complicated when the number of products and machines getting higher. Furthermore, many factors are included in calculating the cost of products add a tedious work. Therefore, dealing with such a problem for a certain case study requires a considerable working time.

In this thesis, an optimization approach is explored to solve the assignment of products in unrelated parallel machines’ environment with an objective function to minimize the overall operation cost. The methodology is to modify the linear programming approach in solving the assignment problem. In addition, criteria affecting the operating cost are defined and transferred to a cost unit to prepare the input matrix for the assignment problem. In specific, the problem is solved using sequential arrangement and parallel arrangement methods.
A real case (a factory for plastic item's production) is studied to verify the proposed solution and to understand the practical side of the management problem. The initial results are discussed with the factory engineers and manager to validate the use of the optimal approach. The interviews' feedback is used to update the optimal solution. As an important result that can be announced is that the actual solution is only suboptimal. This is because incomplete conditions and work constraints are considered; this result indicates the necessity of mixing the prevailing manager rules with theoretical solution methods.
مشكلة التخصيص متعدد المعايير للمنتجات في المعامل الصناعية

إعداد
علا رياض سلام

تعتبر مشكلة تخصيص المنتجات إلى الآلات قضية هامة في المعامل الصناعية، ومن الممكن أن تؤثر بشكل ملحوظ على الكلفة الإجمالية للعمليات التشغيلية. تزداد أهمية ايجاد حل لمشكلة تخصيص المنتجات إلى الآلات باستخدام طريقة منهجية بزيادة حجم المنشأة وزيادة عدد المنتجات والآلات، وزيادة العوامل التي تؤثر على الكلفة التشغيلية، حيث تصبح عملية اتخاذ القرار أكثر صعوبة وذلك لزيادة معطيات المشكلة.

في هذا البحث، تم حل مشكلة تخصيص المنتجات إلى الآلات في بناء الإنتاج التي تتضمن آلات متقلبة غير متماثلة وتحديد تقليل الكلفة الإجمالية المترتبة على تشغيل العمليات. تم حل المشكلة باستخدام خوارزمية مشكلة التخصيص وتم التعديل على طريقة الحل لتناسب مع معطيات المشكلة. تم حل المشكلة باستخدام طريقي الترتيب التسلسلي والترتيب الموتاري.

للتحقيق من الحل الذي تم التوصل إليه في هذا البحث، وفهم الجانب العملي للمشكلة، تم تطبيق دراسة واقعية في مصنع لإنتاج المواد البلاستيكية، وتمت مناقشة النتائج الأولية التي تم الحصول عليها مع مهندسي ومدير المصنع للتحقيق من واقعية الحل. وتم استخدام الملاحظات لتطوير الحل والوصول إلى حل يمكن قبوله عملياً من قبل إدارة المصنع. إحدى النتائج المهمة التي يذكرها أن الحل الأمثل لم يتم قبوله من قبل إدارة المصنع بسبب محددات.

لم يتم اعتبارها من البداية، والحل المقترح هو الحل بديل للحل الأمثل.
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LIST OF ABBREVIATION

PMA: Products-machines Assignment

TAP: Task Assignment Problem

PMS: Parallel Machine Scheduling

AP: Assignment Problem

OEE: Overall Equipment Effectiveness

UPM: Unrelated Parallel Machines

UNB-AP: Unbalanced Assignment Problem

TPM: Total Preventive Maintenance

IMM: Injection Molding Machine