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An Optimization Model for the Arrangement of Assembly Areas Considering Time Dynamic Area Requirements

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Abstract : Large-scale products are often assembled according to the job-site principle, meaning that during the assembly the product is located at a fixed position, while the area requirements are constantly changing. On one hand, the product itself is growing with each assembly step, whereas varying areas for storage, machines or working areas are temporarily required. This is an important factor when arranging products to be assembled within the factory. Currently, it is common to reserve a fixed area for each product to avoid overlaps or collisions with the other assemblies. Intending to be large enough to include the product and all adjacent areas, this reserved area corresponds to the superposition of the maximum extents of all required areas of the product. In this procedure, the reserved area is usually poorly utilized over the course of the entire assembly process; instead a large part of it remains unused. If the available area is a limited resource, a systematic arrangement of the products, which complies with the dynamic area requirements, will lead to an increased area utilization and productivity. This paper presents the results of a study on the arrangement of assembly objects assuming dynamic, competing area requirements. First, the problem situation is extensively explained, and existing research on associated topics is described and evaluated on the possibility of an adaptation. Then, a newly developed mathematical optimization model is introduced. This model allows an optimal arrangement of dynamic areas, considering logical and practical constraints. Finally, in order to quantify the potential of the developed method, some test series results are presented, showing the possible increase in area utilization.

Keywords : dynamic area requirements, facility layout problem, optimization model, product assembly
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