

DESIGN FOR ASSEMBLY METHODS FOR LARGE AND HEAVY
PLATES: AN EXPERIMENTAL DESIGN

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(ABSTRACT)

In spite of advances in industrial automation, manual assembly tasks continue to be an important feature of many industrial operations. In heavy part assembly, some pieces of raw material or equipment are too heavy to be safely handled by an operator. Material handling devices such as Jib cranes or overhead cranes are employed to help operators work safer and, in some cases, faster. However, during full-load productions, these devices could become limited and insufficient resources and hence, delay or extend the cycle times. Not only may the companies not be able to ship the products on time, but the labor and overhead costs also increase from the workers' increased idle time as they wait for a turn to use the devices. Finding a way to utilize the material handling devices more effectively could significantly reduce the total cycle times and production costs.

An assembly task could be separated into three steps: transferring, approaching or positioning, and joining or fixing. The transferring time is principally dependent on the distance. The joining time could be directly reduced by increasing the efficiency of the joining machines. However, the positioning time depends on task difficulties, handling methods, and operators' skills. Therefore, this research focuses on how to specify the task difficulties and improve the efficiency of the handling methods.

In this research, metal plates were used to represent heavy parts. Four handling methods were studied including One-person, Two-person team, One person with an overhead crane, and One person with a spring-equipped overhead crane. This study

applies Fitts' Index of Difficulty as a guideline to determine task difficulty. The results indicate that, for all methods mentioned above, the relationships between moment time and task difficulty are linear. The results also show that, for a part that weighs up to 40 pounds, a two-person team gives the fastest assembly time for every task difficulty. In addition, the assembly performance of one person with an overhead crane could be increased approximately 250% by adding a spring between the hook and the gripper.

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