主　論　文　の　要　約

論文題目　**Feasibility of Schedules under Blocking Constraint**
(閉塞条件下におけるスケジュールの実行可能性)

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論　文　内　容　の　要　約

In order for industries to survive the harsh competition between each other, they have to continue making improvements in their production activities, or it can be said that it will end the future progress of the industry or even the entire world. As a researcher and engineer in the field of production systems, it is also the author's lifetime work to achieve the goal of improving production activities.

A simple way of improving a production activity is to change the operation order of jobs on a specified production resource. By doing so, there is a chance of using the idle time of resources effectively, and hence improving the performance of resources. Moreover, not only are these changes needed for improvement of activities, but they are also needed to correspond with the fluctuating demand inside and outside of the shop. For example, the delivery of parts inside and outside the shop happen daily, and the schedule needs to be changed daily in order to cope with these situations.

However, in order to improve the activities of real world situations, there is a necessity of introducing a particular state of resources to the scheduling theory, which is namely the *blocking* state. Blocking is the state of resources being blocked by products, hence making them incapable of handling other products, which can be assumed to happen frequently in practical situations for reasons such as the lack of buffer. Because of this blocking state, numerous amounts of schedules become infeasible, which is a huge obstacle preventing blocking to be introduced completely into the scheduling

theory.

From this motivation, the realization of changes of schedules considering the blocking of production resources is held as the objective of this thesis. In order to achieve this goal, a method for evaluating the feasibility of a schedule and a method for avoiding infeasible schedules are proposed, and their effectiveness are confirmed analytically.

First, a feasibility evaluation problem is introduced to evaluate the feasibility of a given schedule. Since the operating orders of jobs are given beforehand, the scheduling problem becomes a simple linear programming problem, making it easy for evaluation. An artificial variable is introduced to the optimization problem, and by transforming the problem in a particular manner, feasibility evaluations can be performed continuously making the proposed method less computationally expensive. In fact, it is proven analytically that the proposed feasibility evaluation method's computational time does not depend on the problem's scale, making it possible for feasibility evaluations of large-scaled problems to be performed.

Secondly, 2 methods are proposed for the correction of an infeasible schedule, which is necessary for the search of well-performing schedules. The first method utilizes the extended disjunctive graph for the detection of infeasibility, or more precisely a closed loop on the graph, and then changes other operation orders included in the loop to correct the schedule to a feasible one. The second method utilizes the Gantt chart to identify jobs to be changed for the correction. It especially focuses on the blocking states of the preceding and succeeding processes of the initial change, and operation orders concerned with theses processes are changed for the cancellation of infeasible blocking states. Numerical calculations are carried out to prove the effectiveness of the proposed methods, and it is validated that they can be used to achieve relatively good schedules within a reasonable computational time.

Finally, a practical production activity, namely the multicluster production system, is targeted and the proposed methods are applied for the improvement of a schedule. By utilizing the proposed methods, it is shown that a well-performing schedule can be obtained for real world situations.