



## 資源限制下兩階段求解多專案計畫排程 Two-stage Approach for Solving Multi-project Scheduling with Minimum Makespan under Limited Resource

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### 摘要

專案計畫排程對於營建工程的時程管理，是一個很重要的關鍵議題，對整體工程專案的成本有著重大的影響因素。在現實的環境中，專案經理人經常同時處理多個專案計畫的規劃評估任務，特別是面臨到當資源有限的情況下，更是一大挑戰。本研究中，我們提出了一個求解多專案計畫排程問題的方法，透過運用混合整數線性規劃來建構一套數學模式，對於有資源限制的條件下，計算單一專案或多專案計畫中之作業活動排程，並求解其最小完工工期。專案計畫活動排程則以計畫網路的模式呈現，並以兩階段方式來求解最佳的專案作業活動排程。第一階段先行求解出完成所有專案計畫之最小完工時間，再將第一階段所得到的最小完工時間，做為第二階段的預設條件進行運算，第二階段則以極大化專案作業活動的總閒置時間為目標，計算多專案計畫中，各項作業活動的實際有效開始及實際完成時間。實驗結果證明，此種方式確實為一種實用且有效的方法。

**關鍵詞：**多專案計畫、混合整數線性規劃、專案計畫網路

### Abstract

Project scheduling is one of the key components in the construction industry and has a significant effect on the overall cost. In business today, project managers have to manage several projects simultaneously and often face challenges with limited resources. In this paper, we propose a mixed integer linear programming formulation for the multiple projects scheduling problem with a set of limited resources to the identical activities within the same project or among different projects and minimum makespan objective. The proposed model is based on the Activity on Arrow (AOA) networks, a two-stage approach is applied for obtaining the optimal activities scheduling. At the first stage, the minimum makespan for completing all projects is computed. By fixing the minimum completion time obtained from the first stage, the second stage computation is then to maximize the slack time for each activity in order to obtain the effective start and finish time of each activity in constructing the multiple projects schedule. The experimental results have demonstrated practical viability of this approach.

**Keywords :** Activity on Arrow Network, Mixed Integer Programming, Project Management

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