

## 使用自動化軟體工程方法解決時間排程問題

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### 摘要

目前已經有許多的方法和模式被提出來處理各種不同特性的時間排程問題，這些研究大多數是使用作業研究、人機互動、限制程式、專家系統、或類神經網路等方法來解決時間排程問題，但是這些研究仍然遇到幾個困難點，包括如何應付不斷改變的時間排程需求、缺乏一般化的架構以解決各種不同特性的時間排程問題、硬性與軟性限制條件的處理與求解、以及領域知識如何表達與整合至時間排程系統中。本計畫將提出一個使用自動化軟體工程的系統化方法來解決各種不同的時間排程問題，我們的方法包含多個軟體發展階段的自動化，包括可重用規格擷取的自動化以輔助需求規格的建立、規格驗證的自動化以檢查需求規格的一致性、以及由需求規格自動產生時間排程系統。在本計畫中，我們使用正規化的知識表示法來表達領域知識及建構時間排程系統的需求規格；使用限制結構的概念來組織時間排程問題中所有的硬性與軟性限制條件，並提出限制傳播的方法以求得限制網路的最佳解；以及將需求規格自動轉換為可執行程式可以達到直接在需求規格階段實行軟體維護工作，而不用維護程式碼。因此，針對時間

排程系統需求的改變，我們可經由修改需求規格中相對應的部分，再自動轉換為可執行的時間排程系統來求解，以應付不斷改變的需求。

關鍵字：時間排程系統; 自動化軟體工程; 正規化需求規格

# **An Automated Software Engineering Approach to Solving the Timetabling Problem**

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## **Abstract**

Many approaches and models have been proposed for dealing with a variety of timetabling programs. Most of these work employed operations research, human-machine interaction, constraint programming, expert systems, or neural networks to solve the timetabling problem. However, there are still problems in these work such as dealing with changes, the lack of a generalized framework, dealing with hard and soft constraints, and the capture of knowledge. In this project, we propose an automated software engineering approach to solving various timetabling problems. Our approach provides the automation of several software development processes including specifications elicitation, verification, and automatic programming. We use a formal knowledge representation to capture domain knowledge and to construct the requirements specifications of timetabling systems. Hard and soft constraints are organized in a constraints hierarchy and propagated in the constraints network. Through automatic programming, modification can be directly performed on the specifications rather than on the source code. Therefore, changes in the requirements of a timetabling system can be dealt with by tuning the requirements specification and translating it into an executable timetabling system automatically.

**Key words:** Timetabling Systems; Automated Software Engineering;  
Formal Requirements Specifications