國立陽明交通大學

運輸與物流管理學系

碩士論文

Department of Transportation and Logistics Management

National Yang Ming Chiao Tung University

Master Thesis

共享自駕車接駁服務車隊配置與調度最佳化問題—需求基礎之最佳化模式與演算法

Optimal fleet allocation and reallocation for feeder service operators using shared autonomous vehicles—A demand-based optimization model and its solution algorithm

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共享自駕車接駁服務車隊配置與調度最佳化問題
—需求基礎之最佳化模式與演算法

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摘要

本研究探討以共享自駕車(Shared Autonomous Vehicles, SAV)提供接駁服務的車隊之車輛配置與調度最佳化問題。本研究以時空網路技巧描述共享自駕車在時間與空間維度之流動情形，並以此建立非線性整數規劃模式。為了反映使用者運具選擇行為對於共享自駕車需求之影響，本研究將多項羅吉特模式以限制式方式整合於數學規劃模式中，用以計算在各個時空點之共享自駕車接駁服務需求量。此模式以共享自駕車營運者利潤最大化為目標，求解最佳車隊規模、車輛配置與調度決策。本研究以新竹高鐵站與竹科園區間工作旅次接駁服務為案例，設計不同規模測試範例進行數學模式求解，並發展時間分割演算法提升大規模案例之計算效率。求解結果顯示所發展之模式與演算法能夠有效求解共享自駕車車隊營運相關決策，本研究成果除了具有理論上之貢獻，也提供未來有意進入此市場之共享自駕車業者做為營運管理之實務參考。

關鍵字: 共享自駕車、車隊調度、羅吉特模式、需求導向最佳化、接駁服務

Optimal fleet allocation and reallocation for feeder service operators using shared autonomous vehicles—A demand-based optimization model and its solution algorithm

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Abstract

This study investigates the optimal fleet allocation and relocation problem for shared autonomous vehicles (SAVs) providing feeder services. A time-space network flow technique is employed to describe the movement of SAVs across temporal and spatial dimensions, based on which a nonlinear mixed-integer programming model is developed. To capture the influence of user mode choice behavior on SAV demand, a multinomial logit model is integrated into the mathematical model as a set of constraints to estimate the SAV service demand at each time-space node. The objective of the model is to maximize the SAV operator's profit by determining the optimal fleet size, vehicle allocation, and relocation strategy. Using the commuter trips between Hsinchu High-Speed Rail Station and the Hsinchu Science Park as a case study, various scales of test instances are designed to solve the model, and a time decomposition algorithm is developed to improve computational efficiency for large-scale scenarios. The results demonstrate that the proposed model and algorithm effectively support SAV operational decision-making. This study not only contributes to theoretical development but also provides practical guidance for future SAV operators considering market entry.

Keywords: Shared Autonomous Vehicles, Fleet Scheduling, Logit Model, Demand-Based Optimization, Feeder Service