Preface

Feeder transit system (FTS) aims at arranging access to vehicles located at different depots at all demand points and transporting residents from these selected pick-up stops to transportation hubs (rail station and airport etc.). The FTS transit network, including a set of nodes (transportation hubs, bus stops, demand points, and depots) and links between them, is regarded as an effective tool to provide a better first/last mile service to and from the major fixed-route transit networks. The first/last mile access to major fixed-route transit networks and connectivity of residential areas is one of the main challenges faced by public transit. A well-designed FTS transit network shifted transport demand from individual car traffic to public transport and further enhanced urban sustainability. A feasible solution to the problem is the planning, design and implementation of efficient feeder transit services.

Traditionally, transit services have been divided into two broad categories: the fixed route and the demand responsive. Fixed feeder transit route do not match the desires of individual riders (the locations of pick up and/or drop off points) and the predetermined schedule, while demand-responsive feeder transit route provide the desired flexibility with a door-to-door type of service. Therefore, latter provide increased flexibility, lower operation cost and higher service level compared to the former, especially within low density residential areas. Both of them are an extension of the vehicle routing problems (VRP) and the pickup and delivery problems (PDP). Similar to conventional bus operation, route design and frequency setting are two key activities in FTS operation,

where the former is the input data of the latter, and they affect each other. The various objectives of above varieties of FTSs involve fleet size of company, the travel distance or travel time of route and their related operating costs. However, those different objectives and constraints don't usually change the properties of the problem, which lead to existing algorithms are also used to resolve general models with a combination of one or more objectives.

The book is roughly organized into two parts. In the first part of the book, two integrated models and their algorithms for fixed feeder transit route design were proposed. Chapter 1 specifically presented a mixed integrated integer programming model for joint location and dispatching decisions for feeder bus route design, and solutions were obtained using improved double population bacterial foraging algorithm. Chapter 2 describes an multiple objective integrated model for feeder transit route design and frequency-setting problem with stop selection, and a two-stage genetic algorithm combining the Dijkstra search method was further developed to yield meta-optimal solutions to the model within an acceptable time. In the second part of the book, five models and their algorithms for demand-responsive feeder transit route design were proposed. Chapter 3 begins this part by building an optimization model for demand-responsive feeder transit services with passengers' multiple time windows and satisfaction, and an improved bat algorithm was further developed to yield meta-optimal solutions for the model in a reasonable amount of time. Chapter 4 and 5 studied demand-responsive feeder transit services with fuzzy demand and travel time. Chapter 6 proposed an optimization model for synchronous transfer between the shuttle and feeder bus in demand-responsive feeder transit services. Finally, Chapter 7 attempted to study an optimization model for demand-responsive feeder transit services based on ride-sharing car, and solutions were also obtained using a two-stage genetic algorithm.

Since the objectives and constraints in the design process of the airport, subway and port feeder transit services are similar, all these models and algorithms are universal and consistent. To organize the chapters throughout the book, we unify some characters, concepts and mathematical symbols. Limited by the length and space of books and articles, some chapters has taken the design of rail transit feeder bus system as an example, and some chapters has taken the design of airport shuttle feeder bus system as an example, which were used to verify the effectiveness of these models and algorithms. All chapters are accepted or published in EI and SCI index journals, such as: Transport (Chapter 1), Journal of advanced transportation(Chapter 2), Journal of Nonlinear and Convex Analysis (Chapter 4), Journal of Intelligent and Fuzzy Systems (Chapter 5), Information (Chapter 7), Future Internet (Chapter 3 and 6). Due to the short time, there may be mistakes in the book, please criticize and correct them. We would also like to thank the people involved for their efforts and efforts in each chapter.