

A Fuzzy Programming multiobjective model for Urban Transport Planning

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Abstract

Urban Transport Planning Process is typically decomposed in four main activities: Network Design, Timetable Design, Vehicle Scheduling and Crew Scheduling. These activities are generally executed in sequence. Timetable design is further decomposed in two main activities: frequencies and departures calculation, these activities are also executed in sequence.

The problem being addressed here is about the construction of timetables by executing both subactivities, frequencies and departures calculation in an integrated way. Also, multiperiod scheduling, multiperiod synchronization, and multimodal transport modes are considered. Uncertainty in demand and travel times is also incorporated into the model. The objectives are: to minimize total operations costs (fixed and variables costs), maximizing the number of synchronizations and minimizing the total waiting time of passengers in the system.

Some assumptions of the model are:

- 1) Demand must be fully satisfied
- 2) Headway policies must be obeyed.
- 3) There are some nodes where synchronization should occur.

For modeling uncertainty, triangular fuzzy numbers were used and for ranking fuzzy numbers the method of k-preferences was employed.

Numerical Experiments were carried out over a group of randomly generated instances. The SAUGMECON method was implemented for generating the Pareto fronts.

Keywords

Urban transport planning; multiobjective optimization; fuzzy programming; multimodal system; multiperiod scheduling

Acknowledgements

Biography

Fernando Lopez-Irarragorri is an Associate Professor of the System Engineering Postgraduate Program of the Mechanical and Electrical Engineering Faculty in the Universidad Autonoma de Nuevo Leon, in Mexico. He earned Diplom Matematiker in the University Friedrich Schiller, Germany, Masters in Applied Computer Science in the Technical University of Havana, Cuba and PhD in Technical Sciences in the Technical University of Havana, Cuba. He has published journal and conference papers. Dr Ali has completed research projects with PEMEX, CEMEX, CFE, PCM and other private or government institution in Mexico. His research interests include multicriteria decision support, optimization, big data analytics. He is member of IEEE, International Society of Decision Making.

Paulina A. Avila-Torres is currently a fulltime Employee at Praxair Mexico at the Research and Development team (R&D). Miss Avila holds an Information Technologies Engineering degree from Instituto Tecnologico de Nuevo Laredo, a Master of Sciences Degree in System Engineering from Universidad Autonoma de Nuevo Leon and a Ph.D in System Engineering from the same university. Paulina will also obtain a Ph.D in Enterprise and Economics from the Universidad de Malaga as part of the agreement between both universities. She has participated in important International congresses, she won a scholarship to attend to winter school in stochastic programming. Miss Avila has published journal and conference papers. She was also awarded with the Sofia Kovalevskaya prize for women with outstanding research results in Mexico in year 2014, among other prizes.