**LITERATURE SURVEY**

**The Simulation of Queuing Model for Bangkok Rapid Transit Train Ticket System Using Python**

This paper proposes the simulation model for ticket system of Bangkok rapid transit train. The proposed analysis model is applied by using queuing theory to analyze main queuing delay problem rapid transit train ticket machines. This analysis model has been developed by using python programing language to create software tool for analyzing the existing ticket system comparing with the desire variable condition or redesign the ticket system. Since, proposed software tool use for analyze the effect of existing ticket system by modification to visualize the queuing, delay time, waiting time and etc. The software tool with the simulation model can visualize the 2D animation results and graph for analyzation. The proposed analysis model could be used to any rapid transit train ticket system for impact analysis own existing ticket system.

# Simulation and Optimization of the Ticket Vending Machine Configuration in Metro Stations Based on Anylogic Software

Taking Chengdu metro as an example, first, this paper uses survey data to fit out the random distribution of passenger arrival and the service time of the TVM (ticket vending machine). Then, based on introducing a state correlation theory, a queuing model with obvious service desks is built up. The simulation and parameter passing function of the AnyLogic software is then applied to verify and optimize the above model. Finally, the simulation result has proved the strong feasibility of the model and simulation optimization is able to relieve the passenger queue status resulted from the TVM, and thus it has significance for guiding the configuration of the TVM.

**Modeling and Simulation of Metro Transit Station Walkway as a State-dependent Queuing System based on the Phase-Type Distribution**

Modeling and Discrete-Event Simulation (DES) is usually used in the planning, design and control of traffic and transportation systems. The existing design code for analysis of metro transit station walkways ignores the randomness of passenger arrival and service time of walkways. Moreover the existing analytical approach for analysis is highly complicated and leads to challenging problems. The study reported in this paper details a new DES approach for the analysis of metro transit station walkway considering both the randomness in passenger arrival process and service time of the walkway. The metro transit station walkway is considered as a state-dependent, finite capacity queuing system with the passenger arrival and walkway service process based on the Phase-type (PH) distribution. The three necessary performance measures are obtained by developing a DES model of walkway in SimEvents software. The DES results are then compared to the analytical model for the verification purpose. Moreover, the numerical experiments are conducted to assess the differences in the result of the new DES model and the existing models for different walkway configuration. This research provides a new and simplified approach for the analysis of walkways at metro transit stations.

**Introduction to Queueing Theory and Stochastic Teletraffic Models**

The book aims to enhance intuitive and physical understanding of the theoretical concepts it introduces. The famous mathematician Pierre-Simon Laplace is quoted to say that “Probability is common sense reduced to calculation” . as the content of this book falls under the field of applied probability, Laplace’s quote very much applies. Accordingly, the book aims to link intuition and common sense to the mathematical models and techniques it uses. It mainly focuses on steady-state analyses and avoids discussions of time-dependent analyses.