Master thesis of *Hung-Yi Lee*

An iterative route generation approach for solving the train design problem

Hung-Yi Lee

Department of Industrial and Information Management

National Cheng Kung University

In the freight railroad industry, how to aggregate freight railcars based on different attributes to create blocks and subsequently combine them to create trains have not changed over the past two centuries. This is called a Train Design Problem (TD), which contains two major components: (1) Train Routing (TR) and (2) Block-to-Train assignment (BTA). TR identifies the origin, destination, and route for each individual train, while BTA seeks the best transportation plan for each block that determines which trains to carry it. Hence, as the solution of TR has changed, so does BTA's. To calculate the optimum solution of TD, we need to solve TR and BTA iteratively. This paper proposes an iterative solution method, which first solves TR with two procedures, and then solves BTA with an Integer Programming model. With several speeding-up techniques such as column generation procedure and warm start mechanism, our solution approach can identify a good solution in short time. We also give a modification procedure to further improve the solution quality by adding new train routes that reduces the train imbalances or merges different train routes, which in turn enhances practicality of our solution method. Results of computational experiments indicate that our solution method does well in comparison with those in literatures.

***Keywords*:** Train Design, Train Routing, Block-to-Train Assignment, Integer Program, Column Generation Approach

Thesis advisor: *I-Lin Wang*, ilinwang@mail.ncku.edu.tw
http://ilin.iim.ncku.edu.tw
***Hung-Yi Lee* entered IIM of NCKU in 2011 and graduated in 2013.**