Soutenance de thèse de doctorat de Julie Kienzle

Vous êtes cordialement invité.e.s à la soutenance de thèse de Julie Kienzle qui aura lieu *le* ***mardi 17 novembre à 9h*** **dans la** ***salle 5441*** **au pavillon André Aisenstadt**.

Titre : *Scheduled Service Network Design with Resource Management: Models and Matheuristics for Intermodal Rail Transportation*

Jury :
Kim Yu, présidente
Emma Frejinger, directrice de recherche
Teodor Gabriel Crainic, co-directeur de recherche
Margarida Carvalho, membre
Nikola Bešinović, examinateur externe, TU Dresden

Abstract

Moving freight at low cost and low emissions depends on consolidation: individual shipments rarely fill a vehicle, so carriers combine them into loads that travel together over scheduled transport services for part of their trip. Planning such consolidation in intermodal rail involves several interdependent decisions. Taking the train schedule as given, this thesis addresses how containers are loaded onto railcars, how railcars are assembled into blocks (the units in which they travel together between terminals), how blocks move over scheduled train services, which extra services to run when demand exceeds planned capacity, and how a heterogeneous railcar fleet circulates through the network. We develop scheduled service network design models that integrate heterogeneous resource management, along with solution methods that address these decisions jointly at industrial scale, as demonstrated on large-scale instances from the Canadian National Railway Company.

The thesis comprises three articles. The first introduces the integrated problem, representing railcar circulation as flows balanced at each terminal, and solves it with a general-purpose solver warm-started by a relax-and-fix heuristic. The second models the movement of each railcar as a cycle — a sequence of blocks that brings it back to its home terminal. Because such cycles are far too numerous to enumerate, they are generated within a column-generation matheuristic, starting from cycles drawn from a feasible solution of the arc-based version of the model. The third couples two pricing procedures: one selects blocks, and the other generates cycles for the selected blocks. This reduces problem size and removes the need for a warm-start solution. The integrated models also provide managerial insights. Ignoring loading or fleet management can lead to underestimating the capacity a plan requires, and having each railcar to return to a home terminal calls for a larger fleet than a flow representation suggests. Fleet composition, in turn, shapes how exposed a plan is to schedule disruptions.