



Séminaire-Webinaire conjoint avec / Joint Seminar-Webinar with
Chaire en Planification des systèmes intelligents de logistique et de transport /
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A BRANCH-AND-REPAIR METHOD FOR THREE-DIMENSIONAL BIN SELECTION AND PACKING IN E-COMMERCE

Zoom: <https://uqam.zoom.us/j/89340744251> / Meeting ID: 893 4074 4251

Abstract: Since one challenge in parcel distribution is the high amount of unused space, finding the best-fitting parcel type and the associated packing pattern is important. In the literature, this problem is known as the three-dimensional bin packing problem with rotation. Knowing the right parcel type raises the question of the right parcel type portfolio. We address this by introducing the three-dimensional bin selection problem (3D-BSP). To solve the 3D-BSP, we introduce a decomposition method called branch-and-repair. We show that due to the relaxation a majority of binary decision variables in the master problem can be relaxed and weak combinatorial cuts are avoided without further lifting. Problem-specific acceleration techniques further improve the performance of branch-and-repair. In the numerical study, we show that branch-and-repair reduces the run time by more than two orders of magnitude compared to the mixed-integer programming formulation and instances with millions of binary decision variables and constraints are solved efficiently. The sensitivity analysis shows the trade-off between the costs of variety (depending on the number of parcel types) and costs for unused space. Compared to minimizing unused space, minimizing total costs increases unused space by 6 to 27 percent depending on the portfolio size.

Joint work with Stefan Minner

Bio: Pirmin Fontaine is an assistant professor of operations management at the Catholic University of Eichstätt-Ingolstadt (KU), Ingolstadt School of Management since 2019. Further, he is associated member at the Mathematical Institute for Machine Learning and Data Science at the KU. His main research interests are in large-scale optimization, decomposition techniques, and metaheuristics with applications in logistics, transportation, mobility systems, and supply chain management. He is a recipient of the German Operations Research (GOR) Doctoral Dissertation Prize.

JEUDI / THURSDAY

**2 mars 2023, 10h30
March 2nd, 2023, 10:30**

**Pavillon André-Aisenstadt
Room 5441**

[Zoom](#)

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Responsable / Organizer

Teodor Gabriel Crainic