Scheduling of Intelligent and Autonomous Vehicles under pairing/unpairing collaboration strategy in container terminal: A branch-and-cut algorithm

Jorge Riera-Ledesma*[1] and Shahin Gelareh[2,3]

[1]Departamento de Ingeniería Informática y de Sistemas, Universidad de La Laguna (DIIS, ULL) – Escuela Superior de Ingeniería y Tecnología, Apartado de correos 456, Universidad de La Laguna, 38200 La Laguna, Spain

[2]Shahin Gelareh – Université d'Artois : EALGI2A – Faculté des Sciences Appliquées - LGI2A Technoparc - Zone Futura - 62400 Béthune, France

[3]LGI2A – Université d'Artois : EALGI2A – UArtois, LGI2A (EA 3926), F-62400, Bethune, France, France

Abstract

A new class of Intelligent and Autonomous Vehicles (IAVs) has been designed in the framework of Intelligent Transportation for Dynamic Environment (InTraDE) project funded by the European Union. This type of vehicles has the ability of pairing/unpairing enabling a pair of units to join, transport bigger containers and disjoin again.
We study a scheduling problem associated with this new family of vehicles. This scheduling problem aims at transporting a set of different size containers among different areas in the port platform using a fleet of IAVs. In this problem, each vehicle represents a configurable processor, and moving a container from a location to other represents a job, whose processing might require the synchronized configuration of some specific processors (vehicles). This optimization problem looks for a sequence of settings for each processor, to minimize the makespan.

Previous studies have approached this problem using algorithms based on a Mixed Integer Programming model that linearizes the synchronization constraints by the big-M method. We propose an alternative model which manages the synchronization constraints by combinatorial cuts that remove minimum infeasible subsets detected by exploring its associated dual problem. Its associated branch-and-cut algorithm has shown to be competitive behavior in extensive computational experience.

Keywords: Synchronization, branch and cut, job scheduling

*Speaker