



**IOE 2022**  
INTERNATIONAL CONFERENCE ON  
OPTIMIZATION AND DECISION SCIENCE  
FIRENZE (ITALY) August 30<sup>th</sup> - September 2<sup>nd</sup> - 2022

# ODS2022 – Book of abstracts

the ODS2022 Organizing committee

August 2022

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This book contains all of the abstracts accepted for presentation at the International Conference on Optimization and Decision Science, ODS2022, held in Florence from August 30<sup>th</sup> to September 2<sup>nd</sup>, 2022. The conference is organized within AIRO, the Italian Operations Research Society, with the support of DINFO (Dept. of Information Engineering, Università degli Studi di Firenze). The conference theme is open in the fields of operations research, optimization, problem solving and decision making, and their applications. A special focus is on the theme “Operations Research: inclusion and equity”.

The book of abstracts contains over 230 contributions, 30 of which associated to papers accepted for publication in the AIRO Springer Series volume devoted to the conference. The contributions are organized into 5 parallel streams and about 35 sessions, 14 of which are invited sessions/streams. Four plenary sessions enrich the scientific part of the conference; they are given by world-renowned professors, and they are related to extremely topical and important issues, namely the use of quantitative analytical methods to promote equality and equity, in the many facets that these terms may have. Abstracts are listed day by day, session by session.

The ODS 2022 Organizing Committee

**WE 16:00 PM1 002**

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*A Two-Dimensional Bin Packing Problem with Precedence Constraints in the Sheet Metal Industry*

We consider an optimization problem of practical relevance arising in Salvagnini Italia, a multinational corporation in the sheet metal industry that produces computer numerical control (CNC) machines designed to cut and bend the sheet metal. We focus on cutting machines and we face the problem of determining efficient cutting layouts, that is, given a set of rectangular items to be cut, we want to place them in the available material sheets with the objective

of minimizing the waste. This problem falls into the well-known area of Two-Dimensional Bin Packing Problems (2DBPP) and, given its possible application

in multiple fields, several variants have been proposed during the last decades in the Operations Research literature. Nevertheless, the problem under study presents a set of attributes that, to the best of our knowledge, has never been considered yet. More precisely, we take into account the following practical aspects, coming from the specific cutting technology: two items can either share a side (common cut) or need to be placed at a given minimum distance, and the same may be imposed between an item and the sheets border; 90 degrees rotation is allowed and each item may have mandatory or forbidden placement areas; a hard (resp. soft) precedence may be assigned to each item, meaning that a production order has to be determined for material sheets and items with higher precedence need to (resp. should, the waste being the same) be produced before the others; optional items are also considered.

We devise a Mixed Integer Linear Programming (MILP) model able to integrate the different attributes. Moreover, in order to pursue a secondary objective

of proposing an as compact as possible cutting layout, we present a post-process optimization based on a Strip Packing MILP formulation. The proposed models have been solved on preliminary instances of practical relevance by means of Cplex. Results indicate that the packing model well

integrates the new practical features and that, in combination with the post-process optimization, it returns solutions that fully match the company's needs.

Keywords. 2D-Bin Packing, Sheet Metal Industry, Precedence Constraints, Mixed Integer Linear Programming. References.

[1] M. DellAmico, J. C. Diaz, M. Iori, The Bin Packing Problem with

**Applications; Contributed Session**