UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

**DOTTORATO DI RICERCA / PHD PROGRAM IN
INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING**

Seminar announcement

**Friday 6ᵗʰ December 2024, Time: 9:30 - 10:30
Room CL-I-3, Building 1** - Via Claudio, 21 - NAPOLI

Prof./Dr. Renata Mansini

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Kernel Search: a general-purpose method for MILP problems

Abstract: Kernel Search is a general-purpose framework to tackle general mixed integer linear programs (MILPs). In recent years, it has proven effective in addressing a variety of combinatorial optimization problems, including knapsack, facility location, portfolio selection, and routing problems. The method is based on the solution of a sequence of restricted problems (RPs) obtained by selecting a subset of variables of the original problem, while setting the remaining ones to zero. To build RPs, the algorithm uses information provided by continuous relaxation (value of basic variables, reduced costs) to sort variables and identify the most promising ones (most likely to be selected in an integer optimal solution). The variables at the top of the sorted list form the kernel set, while the remaining variables are grouped into buckets. Each RP is then formulated by combining the kernel set with one bucket at a time, and its solution helps refine the kernel set in an iterative, learn-and-adjust manner. MILP solvers play a crucial role in solving the RPs, as the efficiency and effectiveness of Kernel Search strongly depend on the underlying solver. In this talk, we will provide an overview of the basic method and explore some new directions, including the parallelization of RPs solution, the hybridization of the framework with machine learning techniques, and its potential application as a primal heuristic.

Lecturer short bio: Renata Mansini is a Full Professor in Operations Research, at the Department of Information Engineering (DII) of the University of Brescia (UNIBS), Italy. She holds a Ph.D. from the University of Bergamo and has been Ph.D. Exchange Visitor at Washington University, St. Louis, Missouri (USA). At present, she is Research Vice-Chancellor at UNIBS, the scientific coordinator of the research area Optimization Models and Algorithms, and the director Laboratory of Operations Research (http://or-dii.unibs.it/). She has been in the editorial board of international journals and member of international groups and scientific societies. She served as an international scientific advisor to the Executive Government Agency of the National Science Center of Poland, the Research Grants Council of Hong Kong, China, and the Romanian Council for Research and Development. Her research focus is on Combinatorial Optimization models and algorithms. Her primary research interests lie in MILP models, and in the development of exact algorithms (branch-and-bound, branch-and-cut, branch-and-price), heuristic methods (meta-heuristics, matheuristics), and approximation algorithms (computational complexity, worst-case analysis). She has published more than 130 papers in different application areas including distribution logistics, vehicle and arc routing, financial risk and safety measures, knapsack, and scheduling problems.

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