GOR

Gesellschaft für Operations Research e.V.

Kackertstr. 7 52072 Aachen Tel.: +49 (0) 241 80 23830 Fax: +49 (0) 241 6 80 23830

GOR-AG: Praxis der Mathematischen Optimierung

Dr. Jens Schulz

Mail: schulz-gor'at'gmx.net

Herewith, we invite you to the 108th meeting of the GOR working group "Practice of Mathematical Optimization". This meeting is planned to be held in person (or virtually if circumstances require) with the topic

The World of Cutting, Packing and Placing

The workshop takes place in the physics center Bad Honnef (DPG – Deutsche Physikalische Gesellschaft) on **Thursday and Friday, April 11 & 12**.
The working language will be English to be inclusive for a non-German speaking audience.

Note that the participation in a GOR-AG-Workshop for non-members is subject to a registration fee, unless you are a speaker or a host. Given the uncertainty of Covid, travel restrictions, and company policies, we strongly advise you to book your stay and travel accordingly. Cancellation of the on-site event may occur on short notice, and the organizers will waive the registration fee but will not refund any other cost.

Participation in the workshop is subject to a minor registration fee of 30 Euro for GOR members and 150 Euro for non-GOR members. Bachelor and master students can participate at zero charge for GOR student members and 50 Euro for non-GOR student members.

For accommodation and food/drinks, a service charge needs to be paid at physics center on Thursday or Friday (breakfast included when staying overnight):

- Staying from Wednesday to Friday: 253 Euro
- Staying from Wednesday to Thursday: 164 Euro
- Staying from Thursday to Friday:180 Euro
- Participation only on Friday (no overnight): 56 Euro

Please, register via www.redseat.de/pmo108 no later than April 4th.

The latest information on the meeting is available on the homepage of the GOR (http://www.gor-ev.de/arbeitsgruppen/praxis-der-mathematischen-optimierung/real-world-optimization).

Yours sincerely,

Jens Schulz, Julia Kallrath, Josef Kallrath

(GOR AG)

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The World of Cutting, Packing and Placing

Specific aims

Cutting, packing and placing problems have been extensively studied for many years because of the vast amount of real-world applications they encompass. Application areas include logistics, manufacturing, clothing and material industries. Based on their dimensionality they can be solved in (pseudo-)polynomial time or maybe be NP-hard. One-dimensional problems include such as knapsack, bin packing, and cutting stock Two-dimensional problems include packing of certain shapes such as circles, rectangles or general polygons, e.g., trim loss and strip packing problems. Three-dimensional geometric problems find applications in pallet or container loading, warehouse management etc. Most variants are NP-hard based on a reduction from knapsack or from bin packing. Here, a vast amount of heuristics and approximation algorithms have been developed to tackle real-world instances.

With the rise of CO2-awareness finding a best packing or minimizing resource consumption, such as in trim loss problems, have become standard considerations when designing logistics operations. A need for efficient transportation, such as considered in packing and loading problems for warehouses or container ships, has led to a variety of solution algorithms and techniques explored – from theoretical standpoint and also from a computational perspective. Besides (math-)heuristics, column generation and Benders decomposition are widely applied techniques to solve such real world problems.

The core of this 1.5-day workshop will consist of an attractive schedule of talks covering a broad range of mathematical techniques, theoretical considerations and real world applications around cutting, packing and placement problems. As usual, we will reserve plenty of time for informal exchange and networking.
In talks of 15+5min, 25+5min or 40+5min duration, experts from practice and research will address problems and solutions.

If you are willing to contribute a talk, please feel free to contact any of the organizers.

Jens Schulz (schulz-gor ‘at’ gmx.net)
Julia Kallrath (julia.kallrath ‘at’ h-da.de)

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The venue & accommodation

Venue

Deutsche Physikalische Gesellschaft (DPG)
https://www.dpg-physik.de/ueber-uns/physikzentrum-bad-honnef/kontakt-anfahrt
Physikzentrum Bad Honnef
Hauptstraße 5
53604 Bad Honnef

How to get there?
Bad Honnef has good train connection from Cologne, and a 10 minutes walk from the station to the venue.

Conference dinner

The conference dinner will take place in physics center on Thursday evening.

Accommodation

The physics center offers accommodation for up to 30 participants. You can choose to stay in a hotel nearby. Please, select the appropriate option during registration.

Excursion

An excursion to Konrad-Adenauer Haus in Bad Honnef is planned at no extra charge with a capacity for 40 visitors.
Adenauerhaus Rhöndorf - Führung durch Wohnhaus und Garten
Konrad-Adenauer-Straße 8c
16:30-17:30Uhr

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The following speakers are confirmed:

Hedi Kiraly
Combining computational geometry and operations research in order to solve two-dimensional irregular strip packing problems

Klaus Jansen
Algorithms for monotone moldable job scheduling

Tanya Romanova (Charkiw university)
tba

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108th meeting of the GOR working group “Practice of Mathematical Optimization”

The World of Cutting, Packing and Placing

Thursday, Apr 11, 2024: 09:00 – 18:00

08:30-09:00 *Feel free to join, take a seat and have first chats*

09:00-09:30 **Opening and Welcome** (Jens Schulz)

09:30-10:15 **Tbd**
tbd

10:15-10:45 ---------- Coffee Break ----------

10:45-11:30 Tbd
tbd

11:30-12:00 **Tbd**
tbd

12:00-13:00 ---------- Lunch Break ----------

13:00-13:45 **Tbd**
Tbd

13:45-14:30 **Tbd**
Tbd

14:30-15:00 ---------- coffee break ----------
---------- Taking a Group Photo for the OR News and Press ----------

15:00-15:30 **Tbd**
Tbd

15:30-16:00 **Tbd**
Tbd

16:00-18:00 ---------- Excursion ----------

19:00-21:00 **Conference Dinner**

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Friday, April 12, 2024: 09:00 – 14:00

07:30-09:00	---------- Breakfast at hotels ----------
09:00-09:15	Welcome second day
09:15-10:00	Tbd **Tbd**
10:00-10:45	**Tbd** Tbd
10:45-11:15	----------coffee break ----------
11:15-11:45	**Tanya Romanova** Tba
12:00-13:00	---------- Lunch Break ----------
13:00-13:45	**Tbd** Tbd
13:45-14:00	**Final Discussion – End of the Workshop**

Location: Physics Center, Bad Honnef

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Abstracts and CVs

Hedi Kiraly (University Duisburg-Essen)
Combining computational geometry and operations research in order to solve two-dimensional irregular strip packing problems

In the realm of two-dimensional strip packing problems, both regularly and irregularly shaped polygons are arranged on a large material of fixed width and unlimited length, ensuring that the polygons do not overlap. The primary goal is to minimize the required length of the large material without exceeding its specified width. While heuristic-based nesting methods are often used in the literature to solve these problems, exact model formulations have also been presented in recent decades, which have been solved with commercial solvers. Most linear Mixed Integer Programming (MIP) models are based on the well-known No-Fit Polygons (NFPs). Until 2022, only two linear MIP models based on direct trigonometry had been introduced. By integrating geometrical insights into a mathematical model, we have developed another MIP model formulation that can handle industry-relevant aspects for the first time in the literature. In addition, the concept of "critical vertices" is explained and it is shown how this simplifies the calculations to avoid overlaps.

Hedi Kiraly is a PhD student at the Chair of Logistics and Operations Research, Mercator School of Management, University of Duisburg-Essen. Her research focuses on cutting and packing problems, in particular on two-dimensional irregular strip packaging problems. She considers both convex and non-convex items with or without holes and a limited number of rotation possibilities. She obtained her BSc in Economics from the University of Vienna and her MSc in Economics with a specialization in Supply Chain Management and Logistics from the University of Duisburg-Essen.

Klaus Jansen (University of Kiel)
Algorithms for monotone moldable job scheduling

A moldable job is a job that can be executed on an arbitrary number of processors, and whose processing time depends on the number of processors allotted to it. A moldable job is monotone if its work doesn't decrease for an increasing number of allotted processors. We consider the problem of scheduling monotone moldable jobs to minimize the makespan. We argue that for certain compact input encodings a polynomial algorithm has a running time polynomial in n and log m, where n is the number of jobs and m is the number of machines. We describe how monotony of jobs can be used to counteract the increased problem complexity that arises from compact encodings, and give tight bounds on the approximability of the problem with compact encoding: it is NP-hard to solve optimally, but admits a PTAS. The main focus of this work are efficient approximation algorithms. We describe different techniques to exploit the monotony of the jobs for better running times, and present a (3/2 + epsilon)-approximate algorithm whose running time is polynomial in log m and 1/epsilon and only linear in the number n of jobs.
This is joint work with my students Kilian Grage, Felix Land and Felix Ohnesorge.

Klaus Jansen is Professor in Algorithms and Complexity of the Department of Computer Science at the University of Kiel. His research focuses on scheduling and packing problems, in particular 2D and 3D packing problems and related scheduling problems with tasks that use several processors or resources in parallel. He obtained his Diploma in Computer Science at the RWTH Aachen and PhD and Habitation in Mathematics at the University of Trier.

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Tanya Romanova