

EURO SUMMER INSTITUTE

Cutting and Packing

Porto, July 16-27, 2012

Final Report



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1. General information about the EURO Summer Institute on Cutting and Packing

1.1 Aims and Scope

Cutting and packing problems are hard combinatorial problems, which arise in the context of many real-world applications, both in industry and in services. In general, they require that “large objects” are to be divided into “small items” in such a way that waste is minimized. Problems of this kind may involve the cutting of paper rolls into narrower rolls in the paper industry, the cutting of large wooden boards into smaller rectangular panels in the furniture industry, the cutting of irregularly shaped components of garment from fabric rolls in the fashion industry, but also the packing boxes into containers or the loading boxes on pallets in logistics applications.

The aim of the EURO Summer Institute on Cutting and Packing (ESI-CP) was bringing together young researchers with academic experts in the field. Every participant has presented an unpublished research paper on a topic from Cutting and Packing which has been intensively discussed during workshop sessions of the ESI. In addition to these workshops, the Scientific Program included tutorials on selected topics and invited surveys of recent and an outlook on future developments in the area of Cutting and Packing. An attractive social program has allowed for meeting and socializing. In other words: The ESI-CP has offered a unique opportunity for establishing a personal network, addressing an international audience and creating new research groups.

1.2 Requirements for participation

Participation was limited to early stage researchers, who are PhD students or who have less than two years research experience since completing a PhD. To be eligible, a candidate should have experience in the area of Cutting and Packing and be author of at least one unpublished, high-quality paper to be presented at this Summer Institute. Persons who were interested to attend the ESI-CP have apply for participation to their national OR society, submitting the unpublished paper and their curriculum vitae, which should include a list of publications. Candidates from non-EURO countries should apply through IFORS.

Participation and accommodation were free for the selected participants. The cost of the ESI is jointly met by EURO and other organizations with the exception of travel expenses, which are usually met by the delegating national OR societies.

1.3 Invited Speakers and Scientific Committee

António Miguel Gomes (University of Porto, Portugal),
Gerhard Wäscher (University of Magdeburg, Germany),
José Fernando Oliveira (University of Porto, Portugal),
José Valério de Carvalho (University of Minho, Portugal),
Julia Bennell (University of Southampton, UK),
Maria Antónia Carravilla (University of Porto, Portugal)
Ramón Alvarez-Valdes (University of Valencia, Spain)

1.4 Organizing Committee

António Miguel Gomes (University of Porto, Portugal),
Gerhard Wäscher (University of Magdeburg, Germany),
José Fernando Oliveira (University of Porto, Portugal),
Maria Antónia Carravilla (University of Porto, Portugal).

1.5 Venue

Porto is a beautiful ancient city situated in the north of Portugal on the right bank of the river Douro, facing the Atlantic Ocean. Porto is the second largest city of the country and the most important one in the north of Portugal. The city is well over 1500 years old, its center is classified as world heritage patrimony by the UNESCO. Porto is also known worldwide for its renowned Port Wine.

The ESI was held at the “Seminário de Vilar”. A former convent, it has been rebuilt, expanded and renovated and serves now a convention center, still run by the Diocese of Porto. Located above the river Douro, with simple rooms and no regular-hotel services, accommodation is frequently classified as student hostel. “Seminário de Vilar” is within walking distance of the city center.

2. Participants

The ESI received applications from early stage researchers in the field of cutting and packing from all over the world. The scientific committee selected a group of 17 researchers from Belgium, Brazil, Canada, Germany, Israel, Italy, Portugal, Russia, Spain and the UK to visit the ESI.

Among these applications, 14 students were nominated by European national OR societies and two were nominated by IFORS. In addition, one application was accepted as “free rider”. On very short notice, three accepted people did not attend the ESI.

Benjamín Alonso Barba, *University of Castilla-La Mancha*, Spain
Célia Paquay, *HEC-University of Liège*, Belgium
Elsa Silva, *INESC TEC*, Portugal
Filipe Brandão, *University of Porto - Faculty of Sciences*, Portugal
Jean-François Côté, *Université de Montréal - Département d'informatique et de recherche opérationnelle*, Canada
Leonardo Junqueira, *Federal University of São Carlos*, Brazil
Marat Mesyagutov, *Technische Universität Dresden*, Russia
Maria da Graça Costa, *Polytechnique Institute of Setúbal*, Portugal
Maria Teresa Alonso Martínez, *University of Castilla-La Mancha*, Spain
Marisa Oliveira, *Polytechnique Institute of Porto*, Portugal
Mohsen Afsharian, *Otto-von-Guericke-University Magdeburg*, Germany
Pedro Rocha, *University of Porto - Faculty of Engineering*, Portugal
Xiaozhou Zhao, *University of Southampton*, UK
Yanira González, *Universidad de La Laguna*, Spain

3. Scientific Program

3.1 School format

The ESI was organized around tutorials and paper presentation and discussion. The tutorials were always divided in two parts, with a first part more expositive and a second part including exercises and hands- on practice. For the paper presentation and discussion each paper has been assigned to an ESI professor and to an ESI student for an in depth analysis and study. All students had a 90 minutes slot assigned, in which they have made a presentation, followed by a discussion, led by the previously assigned student and the professor. The overall ESI organization is presented in figure 1.

	Monday 16-Jul-12	Tuesday 17-Jul-12	Wednesday 18-Jul-12	Thursday 19-Jul-12	Friday 20-Jul-12	Saturday 21-Jul-12	Sunday 22-Jul-12	Monday 23-Jul-12	Tuesday 24-Jul-12	Wednesday 25-Jul-12	Thursday 26-Jul-12	Friday 27-Jul-12
09h00	Participants arrival and get-together	Tutorial 1	Tutorial 2	Tutorial 2	Tutorial 3	Boat Trip in Douro River	Day Off	Tutorial 4	Tutorial 5	Tutorial 5	Tutorial 6	Tutorial 7
10h30		Coffee-break						Coffee-break				
11h00		Tutorial 1	Tutorial 2	Tutorial 2	Tutorial 3			Tutorial 4	Tutorial 5	Tutorial 5	Tutorial 6	Wrap-up and farewell
12h30		Open Discussion						Open Discussion				
13h00	Lunch											
14h00	Welcome	Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion	Departure						
15h00	Porto highlights	Coffee-break				Coffee-break						
15h30		Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion		
16h30		Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion	Participant's presentation & discussion
17:30				Visit to Porto wine cellars				Visit to Serralves				
Evening											ESI special dinner	

Figure 1 – Overall ESI organization

3.2 Conference schedule

Monday July 16th

14:00 - 15:00
Opening Session - Welcome Adress

Tuesday July 17th

9:00 - 12:30
Tutorial 1 - Meta-Heuristics Applied to Cutting and Packing Problems, Julia Bennell
14:00 - 15:30
Pallet building and truck loading strategies for an inter-depot transportation problem, Maria Teresa Alonso Martínez
16:00 - 17:30
Integrated Pallet Loading and Container Loading Problem - A Case Study, Maria da Graça Costa

Wednesday July 18th

9:00 - 12:30

Tutorial 2 (Part 1) - 1D C&P problems - models and exact resolution approaches, Valério de Carvalho

14:00 - 15:30

Construction heuristics for two-dimensional irregular shape bin packing with guillotine constraints, Xiaozhou Zhao

16:00 - 17:30

A nonlinear approach to the Nesting Problem, Pedro Rocha

Thursday July 19th

9:00 - 12:30

Tutorial 2 (Part 2) - 1D C&P problems - models and exact resolution approaches, Valério de Carvalho

14:00 - 15:30

An Optimization Model for the Vehicle Routing Problem with Practical Three-Dimensional Loading Constraints, Leonardo Junqueira

Friday July 20th

9:00 - 12:30

Tutorial 3 - Two-dimensional rectangular cutting problems - a survey, Ramón Alvarez-Valdes

14:00 - 15:30

GREC: A local search algorithm for the rectilinear packing area minimization problem, Marisa Oliveira

16:00 - 17:30

GRASP with Path Relinking for the Two-Dimensional Loading Capacitated Vehicle Routing Problem, Benjamin Alonso

Monday July 23rd

9:00 - 12:30

Tutorial 4 - Cutting and Packing Typology, Gerhard Wäscher

14:00 - 15:30

A Comparative Study of Evaluations Heuristics for Solving the Multi-Objective Container Loading Problem, Yanira Gonzalez

16:00 - 17:30

An Exact Algorithm for the Two-Dimensional Orthogonal Packing Problem with Unloading Constraints, Jean-François Côté

Tuesday July 24th

9:00 - 12:30

Tutorial 5 (Part 1) - Constraint Programming applied to Cutting and Packing Problems, Maria Antónia Carravilla

14:00 - 15:30

Fast Pattern-Based FFD and BFD For Large Cutting Stock Problems, Filipe Brandão

Wednesday July 25th

9:00 - 12:30

Tutorial 5 (Part 2) - Constraint Programming applied to Cutting and Packing Problems, Maria Antónia Carravilla

14:00 - 15:30

Exact Solution of a Two-Dimensional Cutting Problem with Defects – A Dynamic Programming-Based Approach, Mohsen Afsharian

16:00 - 17:30

Three Dimensional Bin Packing Problem applied to air cargo, Celia Paquay

Thursday July 26th

9:00 - 12:30

Tutorial 6 - Nesting Problems - algorithms and geometry, A. Miguel Gomes

14:00 - 15:30

Constraint Programming Approaches for 3D Orthogonal Packing, Marat Mesyagutov

16:00 - 17:30

An analysis of problem instances, data sets and problem generators used in computational experiments for the rectangular Identical Item Packing Problem, Elsa Silva

Friday July 27th

9:00 - 10:30

Tutorial 7 - Integration of Cutting and Packing with other problems, José Fernando Oliveira

11:00 - 13:00

Wrap-up and Farewell

3.3 Special journal issues

Papers presented at the ESI, will be considered for possible publication in a special issue on “cutting and packing” of the International Transactions on Operational Research (ITOR).

4. Social Program

4.1 Porto Highlights (July 16, afternoon and evening)



City tour through the world heritage patrimony city center and main attractions (walking and by bus).

4.2 Porto wine cellars (July 19, 16:00 to 20:00)



Visit to J. W. Burmester Cellars, Largo da Ponte D. Luiz, 1, Vila Nova de Gaia
Panoramic cable car trip from riverside to Serra do Pilar:
Crossing bridge D. Luiz I (upper level) to Cathedral Square;
Walking through city center and return to Seminário de Vilar.

4.3 Boat trip in Douro Valley (July 21, all day)



Boat trip (nine and a half hours) to the heart of Douro valley vineyards (Pinhão).
Return to Porto by train.
Dinner at Cervejaria Galiza.
Jazz concert at Palácio de Cristal by Susana Santos Silva Quinteto (free entrance).

4.4 Guimarães (July 22)



Visit to Guimarães - European Capital of Culture.

4.5 Visit to Serralves (July 24, 16:50)



Visit to the Modern Art Museum of Serralves gardens.

4.6 ESI special dinner (July 26, 20:00)



Panoramic Restaurant Portucale.

5. Some images from the ESI









6. Website

A website for the ESI was built and more information on this EURO Summer Institute can be found there:

<http://paginas.fe.up.pt/~esicup/extern/ESI-CP/>

7. Financial report

The ESI-CP budget was built considering EURO support of 1000 € per eligible participant and 1000 € support from APDIO – The Portuguese Operational Research Society. As it was possible to run the ESI in a very inexpensive way, the balance was returned to EURO.

Income		Expenditure	
EURO	16.000,00 €	Conference room	900,00 €
APDIO	1.000,00 €	Accommodation and meals of students	6.828,40 €
Total	17.000,00 €	Accommodation and meals of invited speakers	1.536,36 €
		Coffee breaks	546,10 €
		Invited speakers traveling costs	819,35 €
		Local transportation costs	462,60 €
		Boat trip	2.014,00 €
		ESI Special Dinner	590,00 €
		Other social program activities	710,24 €
		Organization (conference materials)	234,18 €
		Total	14.641,23 €
		Balance returned to EURO	2.358,77 €

Porto, 6th of August of 2012

António Miguel Gomes (chair of the ESI-CP)
 José Fernando Oliveira
 Maria Antónia Carravilla