

**IO 2017**

**Book of Abstracts**

**June 28-30, 2017**

Escola Superior de Ciências Empresariais de Valença

Instituto Politécnico de Viana do Castelo

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# Sponsors and Supporters

We would like to thank our sponsor and supporters for their contribution to the success of the conference.

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# Opening Notes

Welcome to IO 2017!

On behalf of the organization committee, we welcome you to the 18th APDIO congress.

This year, the event will take place at Escola Superior de Ciências Empresariais de Valença, Instituto Politécnico de Viana do Castelo. We will have the opportunity to enjoy the beautiful new facilities of this school and visit Valença, a fortified town located on a hill looking over the left bank of the Minho, opposite the Galician town of Tui, on the main road that connects Santiago de Compostela to Porto. The old district of Valença is a very unusual twinned area, comprising two Vauban-style strongholds joined by an old steel bridge. The international bridge Tui-Valença is one of the most notable works of D. Pelayo Mancebo Y Agreda, a famous Spanish engineer.

We would like to thank the APDIO directive committee for entrusting us with part of the organization of this event and we sincerely hope that our effort will contribute to its success.

In addition, we would also like to thank all the participants that chose to attend this congress of Operational Research. We will do our best to provide all you need to fully enjoy this event. Aside from the expected presentations, there will be spaces to share and exchange ideas.

The social program includes a small visit to the Valença Fortress, a Nacional Monument, a welcome drink on the first day and a dinner on the second day. All was arranged in order to show you a peek of the close surroundings and allow you to re-establish the energy to continue work.

Please don't hesitate to contact any member of the organization committee for anything you may need during the event.



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# Aims and Scope

IO2017 aims to bring together researchers from different scientific areas and with distinct backgrounds, but with common interests in operations research. It should be an important forum of discussion and an environment favorable to the exchange of ideas.

The EstudIO is an important part of the congress since it encourage young students to present their works in an academic environment and helps them in their first steps in the research world.

It is the eighteenth edition of a series of international conferences in operations research organized in Portugal under the auspices of APDIO (the Portuguese Operational Research Society). As in previous editions, APDIO will deliver some awards, to PhD theses, to the best papers in Process Systems Engineering of APDIO members, to the best papers of APDIO members, and to the most voted work of EstudIO.

This year's event theme is Operations Research Pro Bono and some relevance is dedicated to a chosen nonprofit organization, Operação Nariz Vermelho, that tries to take some comfort and joy to hospitalized children.



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# Organizing Committee

Lia Oliveira	Instituto Politécnico de Viana do Castelo Escola Superior de Ciências Empresariais	Chair
Sofia Rodrigues	Instituto Politécnico de Viana do Castelo Escola Superior de Ciências Empresariais	
António Amaral	Instituto Politécnico de Viana do Castelo Escola Superior de Ciências Empresariais	
Filipe Carvalho	Instituto Politécnico de Viana do Castelo Escola Superior de Ciências Empresariais	
Luís Barreto	Instituto Politécnico de Viana do Castelo Escola Superior de Ciências Empresariais	
Sandra Silva	Instituto Politécnico de Viana do Castelo Escola Superior Agrária	



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# Program Committee

A. Ismael F. Vaz, UM, EE

Chair

Agostinho Agra, UA, DM  
Ana Cristina Amaro, IPC, ISCAC | CBS  
Ana Isabel Pereira, IPB, ESTG  
Ana Luisa Custódio, UNL, FCT  
Ana Paula Barbosa Póvoa, ULisboa, IST  
Ana Paula Teixeira, UTAD,  
Armando B. Mendes, UA, FCTs  
Bernardo Almada-Lobo, INESC TEC e UP, FE  
Cândida Mourão, ULisboa, CMAF-CIO e ISEG  
Carlos Henggeler Antunes, UC, DEEC  
Cesaltina Pires, UE, DG  
Clara Bento Vaz, IPB, ESTIG  
Cristina Lopes, IPP, ISCAP  
Domingos Moreira Cardoso, UA, DM  
Fernando José Vicente Freire, AM  
Filipe Alvelos, UM, EE  
Isabel Gomes, UNL, FCT  
João Miranda, IPPort, CERENA, IST  
João Paulo Costa, UC, FEcon  
João Telhada, ULisboa, FC  
Jorge Orestes Cerdeira, UNL, DM

José Fernando Gonçalves, UP, FEcon  
José Fernando Oliveira, UP, FE  
José Manuel Valério de Carvalho, UM, EE  
Lia Oliveira, IPVC, ESCE  
Luís Miguel Cândido Dias, UC, FEcon  
Luís Nunes Vicente, UC, FCT  
Margarida Vaz Pato, ULisboa, ISEG  
Maria Antónia Carravilla, UP, FE  
Maria Eugénia Captivo, ULisboa, FC  
Maria João Alves, UC, FEcon  
Maria Sameiro Carvalho, UM, EE  
Marília Pires, UAlg, FCT  
Mónica Oliveira, ULisboa, IST  
Paulo Sérgio Abreu Freitas, UMad, FCEE  
Pedro Oliveira, UP, ICBAS  
Silvério Simões Rosa, IT e UBI  
Sofia Rodrigues, IPVC, ESCE  
Susana Relvas, ULisboa, IST  
Tatiana Tchemisova Cordeiro, UA, DM  
Teresa Cardoso Grilo, IUL, ISCTE BS  
Tomaz Dentinho, UA, DCA



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# General Information

## Language

The conference official languages are Portuguese and English. No simultaneous translation will be provided.

## Conference Venue

The conference is taking place at the Escola Superior de Ciências Empresariais de Valença do Instituto Politécnico de Viana do Castelo. A map can be found on page 6, indicating the location where sessions, coffee breaks, and lunch are taking place. Signs disposed in the buildings will guide the participants to the sessions rooms.

## Registration Desk

The registration desk will be located at the entrance near the main Auditorium. The registration desk will be opened on Wednesday 28th, from 12:00 to 18:30, and during the remaining days, from 09:00 to 13:00.

## Internet Access

Free wireless access is available through the campus (network name: ESCE-WLAN, without password - Warning: this is an unsecured wireless network).

## Guidelines for Session Chairs

In the Session Chairs Index on page 83 you can find the codes of all the sessions chaired by a given participant. The session location is given in the Abstracts section of the Conference Book. The role of the chair is to coordinate and ensure the smooth execution of the session. As a session chair please make sure to:

- Contact the speakers before the session, to verify who is presenting and to preempt any technical problems.
- Ensure that the session begins and ends on time. All sessions lasts 20 minutes. Time for questions is included. Sessions are organized with 4 or 5 speakers. Open slots may exist in the end of the session.
- Introduce the speaker and the title of each talk.

- Ensure that presentations respect the program order, to allow participants to jump between sessions. If a speaker cancels or does not attend, the session schedules should be respected, rather than shifting every talk backwards.
- When appropriated inform the speaker of the remaining time till the end of the presentation.
- Ask for questions and thank the speaker.

VERY IMPORTANT: We ask session chairs to notify us about any last minute changes or cancellations. These changes will be posted outside the meeting rooms.

## Guidelines for Speakers

In the Session Speakers Index on page 81, next to the speaker name, you can find the code of the session in which a given speaker participates and the corresponding page number. All session rooms will be equipped with laptops or desktop computers and overhead projectors. You may use your own laptop to ensure that your presentation use the right version of the software and fonts installed, so that it looks like what you have planned and designed. Please follow these guidelines to ensure a successful presentation.

- If you bring your own laptop to your session, bring along the power supply cable. You may need an adapter to connect your computer to the local voltage (220) and wall plug type.
- If your laptop is a Mac, bring the required adapter for the external video output.
- Arrive at your session at least 10 minutes before it begins. All presenters in a session should set up and test the connection to the projector before the session begins.
- We encourage speakers to put their presentations on a Universal Serial Bus data stick (USB pen) as a backup.
- Time your presentation to fit the allotted time (20 minutes), including time for questions and audience participation.
- Feel free to bring along copies of your paper to distribute or to provide a handout with related information. No proceedings with complete papers are to be delivered for this meeting. To obtain complete copies of any papers abstracted in the program, please contact the authors directly at the address supplied with each abstract.
- One or more session assistants (student volunteers) will be available at each room. You can address the session assistant for any request or help regarding problems related to audiovisual equipment.

## Lunches

Lunches will be served in the restaurant facilities. You are kindly required to wear your badge.

## Coffee-breaks

Coffee, tea, juices, and bottled water will be available during the conference coffee-breaks.

## Transportation

Transportation to the conference site is available according to the program on page 10. The BUS departs from Hotel Minho and goes by Hotel Lara, arriving at the Escola Superior de Ciências Empresariais/ Business Sciences School. For more information please contact an organization member.

Valença is a small city, where almost all visiting sites are in a walking distance.

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# Social Program

- Wednesday 28th June, from 19:00 to 20:00: **Tour to the Valença Fortress.**

The tour will allow to know some of the most amazing places and stories of the Valença Fortress. The visit will be organized in three groups with three guides. Two groups will be guided in Portuguese language and the other in English language.

- Wednesday 28th June, from 20:00 to 22:30: **Welcome drink**

This special welcome drink will be served in the Pousada de S. Teóónio, a magnificent place inside the Fortress.

- Thursday 29th June, from 20:30 to 24:00: **Conference dinner**

Conference dinner will be served in Quinta do Amorinho.



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# Maps

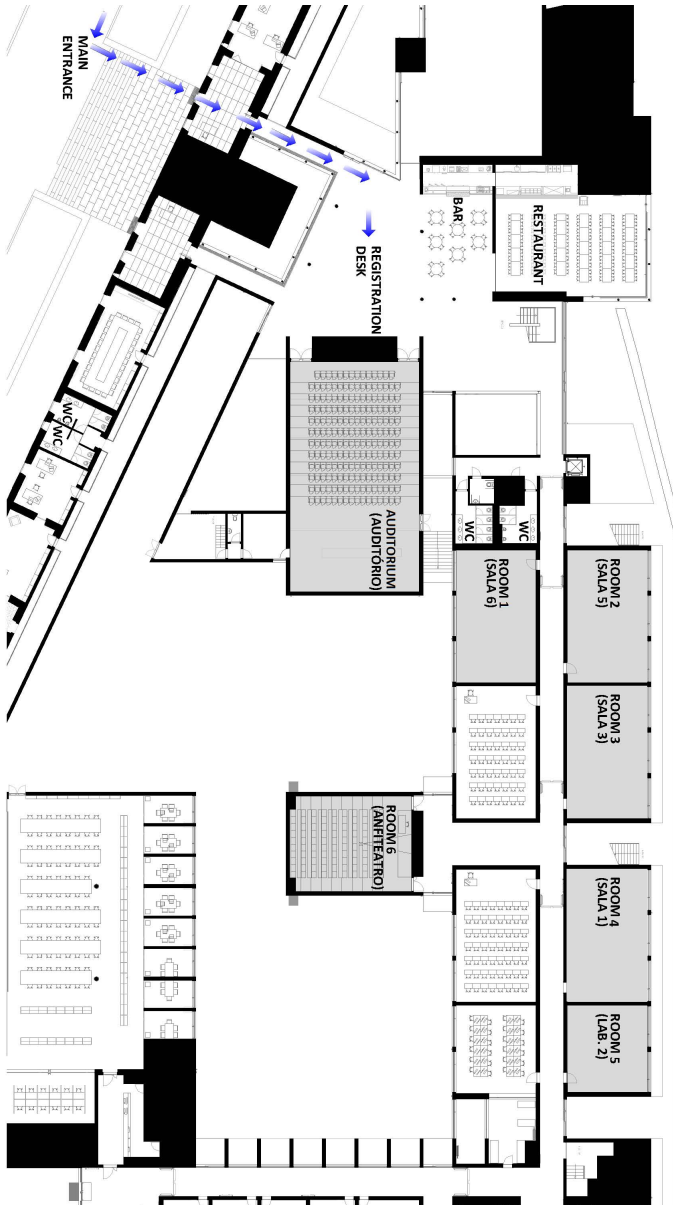
## Campus

Escola Superior de Ciências Empresariais de Valença  
Instituto Politécnico de Viana do Castelo Av. Pinto da Mota  
4930-600 Valença Telef: 258 809 679  
Telm.: 937 300 026 | Fax: 251 800 841 Site: [www.esce.ipv.pt](http://www.esce.ipv.pt)  
E-mail: [geral@esce.ipv.pt](mailto:geral@esce.ipv.pt)

(GPS: [latitude: 42.03163<sup>o</sup> N - longitude: -8.63296<sup>o</sup> E])

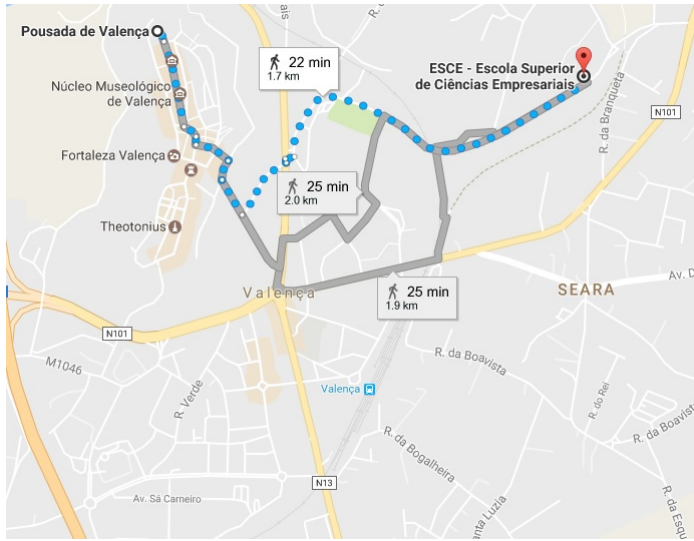
# Conference Rooms

Sessions take place in seven rooms: main Auditorium, Room 1, Room 2, Room 3, Room 4, Room 5, and Room 6.

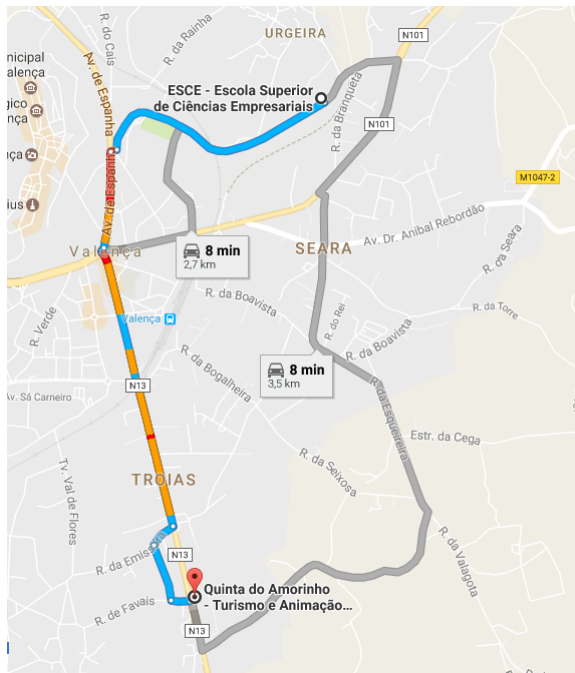




From Pousada de S. Teotónio to the conference site (walking)



From the conference site to the conference dinner site (Quinta do Amorinho)



# Program Overview

28/jun	
10:45 (Arrival@ 12:00)	Shuttle Braga - Valencia
12:00	Registration
13:00	Shuttle Hotel Mirno - Hotel Lara - ESCE
14:00	Opening Session
14:00 - 15:00	
15:00 - 16:00	Parallel Session I Ana Paula Pires
16:00 - 16:20	ICD Free Board "The 4.5 Member Revolution"
16:20 - 16:50	Coffee Break
16:50 - 18:30	Parallel Sessions (four talks per session)
18:35	Shuttle ESCE - Murallas
19:00 - 20:00	Tour Murallas de Valencia
20:00 - 22:30	Welcome "Amanhã de Hoje"
22:30	Shuttle Valencia - Hotel Mirno

29/jun	
09:00	Shuttle Hotel Mirno - Hotel Lara - ESCE
09:30 - 10:50	Parallel Sessions (four talks per session)
10:50 - 11:20	Coffee Break
11:20 - 13:00	Parallel Sessions (five talks per session)
13:00 - 14:30	Lunch
14:30 - 15:30	Parallel Session II Ruth Kaufman
15:30 - 16:50	Parallel Sessions (four talks per session)
16:50 - 17:20	Coffee Break
17:20 - 19:00	APPJO General Assembly
19:05	Shuttle ESCE - Hotel Lara - Hotel Mirno
20:00	Shuttle Hotel Mirno - Hotel Lara - Quinta do Amorinho"
20:30 - 00:00	Conference Dinner
00:00	Shuttle "Quinta do Amorinho" - Hotel Lara - Hotel Mirno

30/jun	
09:00	Shuttle Hotel Mirno - Hotel Lara - ESCE
09:30 - 10:50	Parallel Sessions (four talks per session)
10:50 - 11:20	Coffee Break
11:20 - 12:20	Parallel Session III Ricardo Vazdas
12:20 - 13:00	Awards Ceremony and Closing Session
13:00 - 14:30	Lunch
14:30 (Arrival@ 15:45)	Shuttle Braga - Valencia (1)

Note (1): A luggage storage room will be available during the morning of June 30.

**Wednesday, June 28, 16:00-16:20**

**Wed.0.0** OR Pro Bono, Session, Auditorium ..... 19  
**C. Hiolanda Esteves** *"Rir é o Melhor Remédio?": Estudo do Impacto da Intervenção dos Doutores Palhaços da Operação Nariz Vermelho*

**Wednesday, June 28, 16:50-18:30**

**Wed.1.1** Estúdio, Session, Room 1 ..... 19  
**Ana Raquel Aguiar** *Planning home health care services - a routing and scheduling problem*  
**Daniel Bandeira** *Impressão tridimensional bimaterial por processo aditivo*  
**Raphael Cordeiro** *Sistema de apoio à decisão para elaboração de mapas de exames no ensino superior*  
**João Gonçalves** *Optimal control strategies for an advertisement viral diffusion*  
**Juliana Marques** *Impacto da uniformização e centralização de consumos em contexto hospitalar*  
**Wed.1.2** DEA and Performance Analysis, Session, Room 2 ..... 20  
**Renata Oliveira** *The evaluation of the social performance of mining firms*  
**Rui Cunha Marques** *Malmquist and Hicks-Moorsteen productivity indexes for clusters performance evaluation*  
**Rui Marques** *Análise analítica da eficiência de rega usando modelos determinísticos e estocásticos*  
**António Fernandes** *Efficiency and Capital Structure in Portuguese SMEs*  
**André S. Veloso** *Determinants of nursing homes performance: The case of Portuguese Santas Casas da Misericórdia*  
**Wed.1.3** Production and Inventory Management, Session, Room 3 ..... 22  
**Serhat Saylam** *A spreadsheet based model that estimates the impact of reduced distribution time on inventory investment savings*  
**Maria Pires** *Solving the backroom design problem*  
**Jorge Mendes** *Review policies for online retail inventory management considering customer order time windows*  
**João Correia Pinto** *A prescriptive analytics method applied to a maintenance and manpower scheduling problem*  
**Paula Alves** *Desenvolvimento de uma metodologia para redução do volume de obsoletos numa empresa do sector automóvel*  
**Wed.1.4** Data Analysis and Artificial Intelligence, Session, Room 4 ..... 24  
**Alvaro Neuenfeldt Júnior** *The two-dimensional strip packing problem: what matters?*  
**Isabel Cristina Lopes** *The reverse logistics of unsold medications in pharmacies in Campania, Italy*  
**José Oliveira** *Optimization of short-term storage of containers in empty container terminals*  
**Gonçalo Figueira** *Automatic learning of planning rules for operations management problems*  
**Helena Alvelos** *Melhoria do processo de corte a laser numa empresa metalomecânica*  
**Wed.1.6** Logistics and Supply Chain, Session, Room 6 ..... 25  
**Bruna Mota** *Green supply chain design and planning: the importance of decision integration in optimization models*  
**Pedro Amorim** *Leveraging logistics flows to improve the sludge management process of wastewater treatment plants*  
**Nuno Falcão e Cunha** *Supply chain modelling and supplier selection in the aerospace industry*  
**Ana Cristina Amaro** *Pharmaceutical Supply Chain: a comprehensive optimal planning for medicine shortage*  
**Ana Paula Barbosa Póvoa** *Design and planning of sustainable supply chains - the case study of a tissue paper business*

**Thursday, June 29, 9:30-10:50**

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<b>Thu.1.1</b> Other Models, Methods, and Algorithms, Session, Room 1 .....	27
<b>Maria Ant3nia Carravilla</b> <i>Understanding complexity in a practical combinatorial problem using Mathematical Programming and Constraint Programming</i>	
<b>Manuel Vieira</b> <i>A formulation for the multi-row layout problem</i>	
<b>Maria Jo3o Alves</b> <i>Ilustra3o de diferentes tipos de solu3o3es em problemas de programa3o em dois n3veis semivectorial</i>	
<b>Thu.1.2</b> Multicriteria I, Session, Room 2 .....	29
<b>Manuel Matos</b> <i>Abordagem multicrit3rio ao problema de expans3o de um sistema produtor el3trico</i>	
<b>Dalila B. M. Martins Fontes</b> <i>Evaluating suppliers in the olive oil sector using AHP</i>	
<b>Ana Sara Costa</b> <i>The quality of service: An overall performance assessment for water utilities</i>	
<b>Luis C. D3as</b> <i>Uma abordagem de avalia3o multicrit3rio para classifica3o e ordena3o de alternativas conjugando Delphi e ELECTRE TRI</i>	
<b>Thu.1.3</b> Multiobjective, Session, Room 3 .....	30
<b>Saman Aminbakhsh</b> <i>An efficient heuristic method for Pareto oriented optimization of timecost tradeoff problem for construction projects</i>	
<b>Jo3o Soares</b> <i>Use of analytic hierarchy process (AHP) to support the decision-making about destination of a batch of defective products with alternatives of rework and discard</i>	
<b>Helga Pereira</b> <i>Multiobjective irrigation model. The Alqueva river basin.</i>	
<b>Sandra Silva</b> <i>A log3stica humanit3ria e a log3stica empresarial: rela3o3es e desafios.</i>	
<b>Thu.1.4</b> Health and Life Science I, Session, Room 4 .....	32
<b>Diogo Cunha Ferreira</b> <i>Economies of scope in health sector: the case of Portuguese hospitals</i>	
<b>Sofia Cruz-Gomes</b> <i>What future for healthcare expenditures? A time series analysis</i>	
<b>Liliana Freitas</b> <i>A novel participatory approach to scenario building: application to the evolution of population health inequalities in Europe</i>	
<b>Filipe Alvelos</b> <i>A priori crossmatching in kidney exchange programs</i>	
<b>Thu.1.5</b> Discrete Optimization, Graphs, and Geometry I, Session, Room 5 .....	34
<b>Margarida Carvalho</b> <i>Existence of Nash equilibria on integer programming games</i>	
<b>Ricardo Soares</b> <i>Planning wood chips delivery to bioenergy centrals</i>	
<b>William Hitoshi Tsunoda Meira</b> <i>A decomposition approach for the long-term scheduling of a single-source multiproduct pipeline network</i>	
<b>Domingos Cardoso</b> <i>Grafos com n3mero de estabilidade quadr3tico convexo: principais resultados e problemas em aberto</i>	
<b>Thu.1.6</b> Location, Logistics, Transportation, and Traffic I, Session, Room 6 .....	35
<b>Arsham Atashi Khoei</b> <i>Energy minimizing p-connected covering location problem</i>	
<b>Elsa Silva</b> <i>An intercontinental replenishment problem: A hybrid approach</i>	
<b>Jos3 Correira</b> <i>Otimiza3o de rotas para abastecimento de linhas de montagem</i>	
<b>Ana Moura</b> <i>Otimiza3o da gest3o de agendamento de presta3o de cuidados de sa3de</i>	

**Thursday, June 29, 11:20-13:00**

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<b>Thu.2.1</b> Production Management and Supply Chain, Session, Room 1 .....	37
<b>F3bio Neves-Moreira</b> <i>The time window assignment vehicle routing problem with product dependent deliveries</i>	
<b>Larissa Oliveira</b> <i>A matheuristic for the irregular strip packing problem</i>	
<b>Ana Raquel Xambre</b> <i>Postponement: defini3o do ponto de desacomplamento com recurso a um procedimento para a forma3o de fam3lias de produtos</i>	

**Thu.2.2** Multicriteria II, Session, Room 2 ..... 38  
**Max Oliveira** *Métodos de decisão multicritérios: um estudo empírico aplicado à segurança pública*  
**Ana Vieira** *Shaping Delphi processes to inform multicriteria decision analysis in the healthcare context*  
**Monica Oliveira** *Overcoming common critical mistakes in building composite indices through the MACBETH socio-technical approach*

**Thu.2.3** Energy, Environment, Natural Resources, and Weather I, Session, Room 3 ..... 39  
**Andreia Santos** *OR methods applied to forest-based supply chains considering economic, environmental and social perspectives - A systematic review*  
**Leão José Fernandes** *Downstream petroleum supply chains' design and planning - contributions and roadmap*  
**Alexandra Marques** *A collaborative platform to enhance sustainability in forest-based supply chains*  
**Amilcar Arantes** *Towards sustainability in the construction and demolition waste industry: a case study on application of lean methodology*

**Thu.2.4** Health and Life Science II, Session, Room 4 ..... 41  
**Susana Rafaela Martins** *Warfarin dose optimization with genetic algorithms*  
**Joana Faria** *Planning health workforce training in the detection and prevention of excessive alcohol consumption: an optimization-based approach*  
**Teresa Cardoso-Grilo** *Planning the delivery of long-term care: Improving location-allocation multi-objective stochastic models through scenario reduction techniques*  
**Marta Monteiro** *Planning healthcare workforce training: a multi-objective mathematical programming model*  
**Maria Eugénia Captivo** *Local search heuristics for a surgical case assignment problem*

**Thu.2.5** Nonlinear Optimization, Session, Room 5 ..... 43  
**M. Fernanda P. Costa** *A penalty approach for solving nonsmooth and nonconvex MINLP problems*  
**A.I.F. Vaz** *A branch and bound method for convex semi-infinite programming*  
**Tatiana Tchemisova** *A generator of nonregular semidefinite programming problems*  
**Sérgio Pereira** *Can optimization help additive manufacturing?*  
**Ana Luisa Custodio** *An approach based on nonmonotone directional direct search to noisy optimization*

**Thu.2.6** Location, Logistics, Transportation, and Traffic II, Session, Room 6 ..... 45  
**Beatriz Brito Oliveira** *A dynamic programming approach for integrating dynamic pricing and capacity decisions in a rental context*  
**António Ramos** *Cargo stability in the container loading problem - State-of-the-art and future research directions*  
**Leonor S. Pinto** *Rotas para recolha de valores nos arcos*  
**Carolina Soares de Moraes** *Waste collection planning based on real-time information*  
**Maria Isabel Gomes** *A biased-randomized heuristic for the home healthcare routing problem*

**Thursday, June 29, 15:30-16:50**

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**Thu.3.1** Scheduling and Sequencing I, Session, Room 1 ..... 47  
**Afshin Mehraei** *Decentralized sequencing in real-time in job scheduling problem*  
**Hendrik Vermuyten** *Optimizing staff scheduling: a case at INEM*  
**Sara Martins** *Heurística de escalonamento para um laboratório de análises de vinhos*  
**Rui Borges Lopes** *Heuristic approaches for a flexible job-shop scheduling problem*

**Thu.3.2** Multicriteria III, Session, Room 2 ..... 48

**Luis Dias** *Optimising costs and risks in asset management*  
**Jéssica de Freitas** *Investment portfolio formation via multicriteria decision aid: A brazilian stock market study*  
**Alberto Martinho** *Location-routing problems: Sectorization and multicriteria*  
**Thu.3.3** Energy, Environment, Natural Resources, and Weather II, Session, Room 3 ..... 49  
**Francisco Silva Pinto** *A framework for suitable prices: the role of alternative tariff structures in water supply projects*  
**William Machado Emiliano** *Bus fleet management optimization using the augmented weighted Tchebycheff method*  
**Ricardo Lima** *Risk-averse stochastic programming vs robust optimization and sample average approximation for a virtual power plant*  
**Thu.3.4** Metaheuristics I, Session, Room 4 ..... 51  
**Carlos Iglésias** *Solving large-scale railway line planning problems using a genetic algorithm*  
**Xavier Andrade** *An heuristic approach to product line trimming decisions*  
**Ana Sofia Carvalho** *Ambulance dispatching and relocation problem*  
**Ana Paula Teixeira** *Diabetes: Introduction to the analysis of the temperature of the foot*  
**Thu.3.5** Discrete Optimization, Graphs, and Geometry II, Session, Room 5 ..... 52  
**Telmo Pinto** *Models and advanced optimization algorithms for the integrated management of logistics operations*  
**Anabela Costa** *Heuristic algorithms for a capital budgeting problem with the option to defer*  
**Pedro Rocha** *Reducing geometric complexity of irregular pieces for nesting problems.*  
**Marta Castilho Gomes** *New approach for optimization of construction and demolition waste management: Application to the Lisbon metropolitan area*  
**Thu.3.6** OR Teaching, Session, Room 6 ..... 54  
**Susana Fernandes** *GLP-Tool: uma ferramenta gráfica, dinâmica e interativa para introdução à programação linear*  
**João Miranda** *Estudo europeu em investigação operacional no ensino superior: resultados importantes e tendências preliminares*  
**José Soeiro Ferreira** *Investigação operacional e artes marciais*

**Friday, June 30, 9:30-10:50**

**Fri.1.1** Scheduling and Sequencing II, Session, Room 1 ..... 55  
**Mariana Nogueira** *Scheduling of nonconforming devices: the case of a company in the automotive sector*  
**Arminda Pata** *Aplicação de meta-heurísticas para minimização de lesões músculo esqueléticas relacionadas com o trabalho*  
**Nicolau Santos** *Simultaneous management of sequence dependent setups and work in progress in a flexible job shop*  
**Ana I. Pereira** *Optimal procedures to schedule home care visits in a health center*  
**Fri.1.2** Optimization and Multiple Parties, Session, Room 2 ..... 56  
**Aydin Teymourifar** *An analysis of the effects of pricing and government subsidies on patients' hospital choices and social utility through simulation*  
**Sara Martins** *MCVRP with product-specific time-windows assignment*  
**Zhor Chergui** *Reference points, which impact can have upon the reliability of the MCDM methods, TOPSIS methods for Group decision makers & interval data : study and comparison*  
**João P. Almeida** *Hotelling game on networks*  
**Fri.1.3** Optimal Control and Systems Dynamics, Session, Room 3 ..... 58

**Carlos Balsa** *A direct approach to a control problem in passive tracer advection by viscous point vortex flow*

**Olena Kostylenko** *Banking risk as an epidemiological model: an optimal control approach*

**Ricardo Cunha** *Agile real-time decision making*

**Helena Sofia Rodrigues** *Epidemiological models and the diffusion of an advertising campaign*

**Fri.1.4** *Metaheuristics II, Session, Room 4* ..... 59

**Parisa Sadeghi** *Balancing mixed-model assembly systems with a variable neighbourhood descent method*

**Nelson Chibeles-Martins** *Abordagem heurística na avaliação no sumódulo de risco de incêndio em Solvência II*

**Cláudio Alves** *Variable neighborhood search for integrated planning and scheduling problems*

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**Luís Pereira** *The level of detail in simulation models: why does it matter?*

**Ruben Dias** *A simulation and optimization framework for integrated planning and process design*

**Mário Amorim Lopes** *A stochastic agent-based model with optimization strategies for nursing workforce planning*

**Ricardo Lucas** *The PackNStore case study*

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**Miguel Vieira** *A decision-support framework for the planning optimisation of biopharmaceutical industrial processes*

**Catarina Marques** *A simulation-optimization framework to address the stochastic nature of process design and planning decisions in the chemical-pharmaceutical industry*

**Pedro Castro** *Continuous-time formulations for multiproduct pipeline scheduling*

**Helena Paulo** *Integrating stochastic programming with scenario reduction methods to support the design of biomass to bioenergy supply chains under uncertainty*

with linear transportation costs from a line (city) to a network (town). We show the existence of a pure Nash equilibrium price if, and only if, some explicit conditions on the production costs and on the network structure hold. Furthermore, we prove that the local optimal localization of the firms are at the cross-roads of the town.

■ **Fri.1.3**, Friday, June 30, 9:30-10:50, Room 3

## Optimal Control and Systems Dynamics

Session chair: *Helena Sofia Rodrigues*

### 1. A direct approach to a control problem in passive tracer advection by viscous point vortex flow

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**Keywords:** Keywords:Viscous Point Vortex Flow, Passive Tracer, Control Problem, Numerical Optimization

Vortex dynamics and passive tracers in vortex-dominated flows form a vast area of research that continues to attract the attention of numerous studies. Among these studies, it has emerged in recent times a special interest in the use of control theory applied to vortex dynamics. Viscous point vortices are singular solutions of the two-dimensional incompressible Euler equations. These solutions correspond to the limiting case where the vorticity is completely concentrated on a finite number of spatial points each with a prescribed strength/circulation. By definition, a passive tracer is a point vortex with zero circulation. We are concerned with the dynamics of a passive tracer advected by two-dimensional viscous point vortex flow. More precisely, we want to drive a passive particle from an initial starting point to a final terminal point, both given a priori, in a given finite time. The flow is originated by the displacement of  $N$  viscous point vortices. More precisely, we look for the optimal trajectories that minimize the objective function that correspond to the energy expended in the control of the trajectories. The restrictions are essentially due to the ordinary differential equations that govern the displacement of the passive

particle around the viscous point vortices.

### 2. Banking risk as an epidemiological model: an optimal control approach

*Olena Kostylenko* (o.kostylenko@gmail.com) Center for Research and Development in Mathematics and Applications (CIDMA), Department of Mathematics, University of Aveiro, 3810-193 Aveiro, Portugal, *Olena Kostylenko*, *Helena Sofia Rodrigues*, *Delfim F. M. Torres*

**Keywords:** banking risk, contagion spread, epidemic approach, optimal control.

The process of contagiousness spread modelling is well-known in epidemiology. However, the application to banking market is quite recent. In this work, we present a system of ordinary differential equations, simulating data from the largest European banks. Then, an optimal control problem is formulated in order to study the impact of a possible measure of the Central Bank in the economy. The proposed approach enables qualitative specifications of contagion in banking obtainment and an adequate analysis and prognosis within the financial sector development and macroeconomic as a whole. We show that our model describes well the reality of the largest European banks. The main simulations were done using MATLAB and BOCOP optimal control solver, and the main results are taken for three distinct scenarios.

### 3. Agile real-time decision making

*Ricardo Cunha* (gei12049@fe.up.pt) INESC TEC, *Ricardo Cunha*, *Gonçalo Figueira*, *Pedro Amorim*

**Keywords:** Scheduling ; Decentralized Decision Making ; Real-Time

Customers demand for more variety and a quicker response, which, in addition to the new technology that is populating the Industry 4.0, result in increasingly complex and uncertain production environments. There is thus the need for new decision making tools to act on a real-time basis. Traditional production process modelling techniques rely heavily on central decision making structures, which present numerous disadvantages when dealing with real