Internacional Symposium on Combinatorial Optimization

ISCO 2024

Universidad de La Laguna, Tenerife, 22-24 May 2024

Conference Handbook

Check https://eventos.ull.es/isco-2024 for the last version.

Contents

WLAN access

• The Wi-Fi network **eduroam** can be used for internet access, provided your home organization participates in the *eduroam* federation.

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SSID :   ULL-CONECTA

EAP method: PEAP

Phase 2 authentication: MSCHAPv2

Domain: radius.ull.es

Identity: isco2024@eventos.ull.es

Password: tenerife2024isco

Foreword

Welcome to ISCO 2024 in *Universidad de La Laguna* (ULL), Tenerife, Spain.

International Symposium on Combinatorial Optimization (ISCO) is a biennial symposium whose aim is to bring together researchers from all the communities related to combinatorial optimization, including algorithms and complexity, mathematical programming, operations research, optimization under uncertainty, graphs and combinatorics. It is intended to be a forum for presenting original research in these areas and especially in their intersections. Quality papers on all aspects of combinatorial optimization, from mathematical foundations and theory of algorithms to computational studies and practical applications, are welcome to be presented at the conference.

* The first ISCO conference was held in Hammamet, Tunisia, in March 2010.

* The second ISCO conference was in Athens, Greece, in April 2012.

* The third ISCO conference was in Lisbon, Portugal, in March 2014.

* The fourth ISCO conference was in Vietri, Italy, in May 2016.

* The fifth ISCO conference was in Marrakesh, Morocco in April 2018.

* The sixth ISCO conference was intended to be at HEC Montreal and University of Montreal, Canada, in May 2020, but due to the COVID-19 pandemic, the conference was held online focusing on "regular papers" only.

* The seventh ISCO conference was in Paris, France, in May 2022, also online.

ISCO conferences are referenced in well-known databases like:
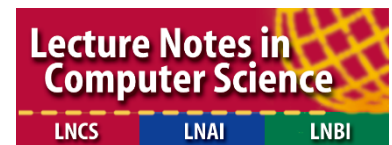
We are delighted to resume in-person activities and welcome you to ISCO 2024 at the School of Mathematics (Faculty of Science) in *Universidad de La Laguna* (ULL).

ISCO 2024 is preceded by a **Spring School** which is oriented to PhD students, but the lectures are also open to other researchers interested to learn about the topic.

ISCO 2024 was preceded by the doctoral school entitled "Combinatorial Optimization and Machine Learning" given by Amitabh Basu (Johns Hopkins University, Baltimore, USA) and Andrea Lodi (Cornell Tech and Technion, New York, USA) on 20-21 May 2024. Three eminent invited speakers also gave talks at the symposium: Claudia Archetti (ESSEC, Paris, France), Francisco Barahona (IBM T. J. Watson Research Center, Yorktown Heights, USA), and Jon Lee (University of Michigan, Ann Arbor, USA).

Both the school (20-21 May 2024) and the conference (22-24 May 2024) take place at the School of Mathematics, Faculty of Science, University of La Laguna, 38200 La Laguna, Tenerife, Canary Islands, Spain.

In response to the public call-for-papers ISCO 2024 received 113 submissions in two categories: 46 regular papers (12 pages) and 67 short abstracts (3 pages). Each regular paper was reviewed by three to four Program Committee members with the assistance of external reviewers. The submissions were judged on their originality and technical quality. The review process was extremely selective, and many good papers could not be accepted. As a result, 30 regular papers were selected, giving an acceptance rate of 65%. The revised versions of the selected regular papers are included in volume 14594 of *Lectures Notes in Computer Science*, by Springer. Some of the submitted short abstracts were rejected by a Program Chair and others were withdrawn by the authors. The scientific program includes three lectures by the invited speakers, 30 selected regular papers and 54 accepted short abstracts. Overall, 84 talks of 25 minutes each, grouped into 28 sessions, are scheduled at ISCO

2024, with at most three sessions running in parallel. All the accepted submissions, together with abstracts and short biography of the invited speakers, are included in this booklet.

We thank all the authors who submitted their research work to ISCO 2024, and the Program Committee members and external reviewers for their exceptional work. We also thank the three invited speakers as well as the two invited lecturers of the doctoral school. They all contributed to the scientific quality of the symposium.

Finally, we thank the institutions sponsoring ISCO 2024: *Universidad de La Laguna (ULL), Turismo de Tenerife (Cabildo de Tenerife), Ayuntamiento de San Cristóbal de La Laguna, Ministerio de Ciencia (Gobierno de España), Sociedad de Estadística e Investigación Operativa (SEIO), Instituto Astrofísico de Canarias (IAC),* and the Association of European Operational Research Societies (EURO).

ISCO 2024 local organising committee have taken care to minimise our carbon footprint and to foster inclusion and diversity. Our first goal is to please everybody. Please accept my apologies when we failed.

Enjoy ISCO 2024,

Juan-José Salazar-González

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Amitabh Basu (Johns Hopkins University, USA)

Ali Ridha Mahjoub (Kuwait University, Kuwait ; Paris Dauphine University, France)

Juan José Salazar González (Universidad de La Laguna, Tenerife, Spain)

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Luze	Xu	University of California, Davis	USA

Venue

ISCO 2024 takes place on the ground floor of the School of Mathematics, Faculty of Science, Universidad de La Laguna, at Avenida Astrofísico Francisco Sánchez s/n, 38200 San Cristóbal de La Laguna, Santa Cruz de Tenerife, Canary Islands, Spain.
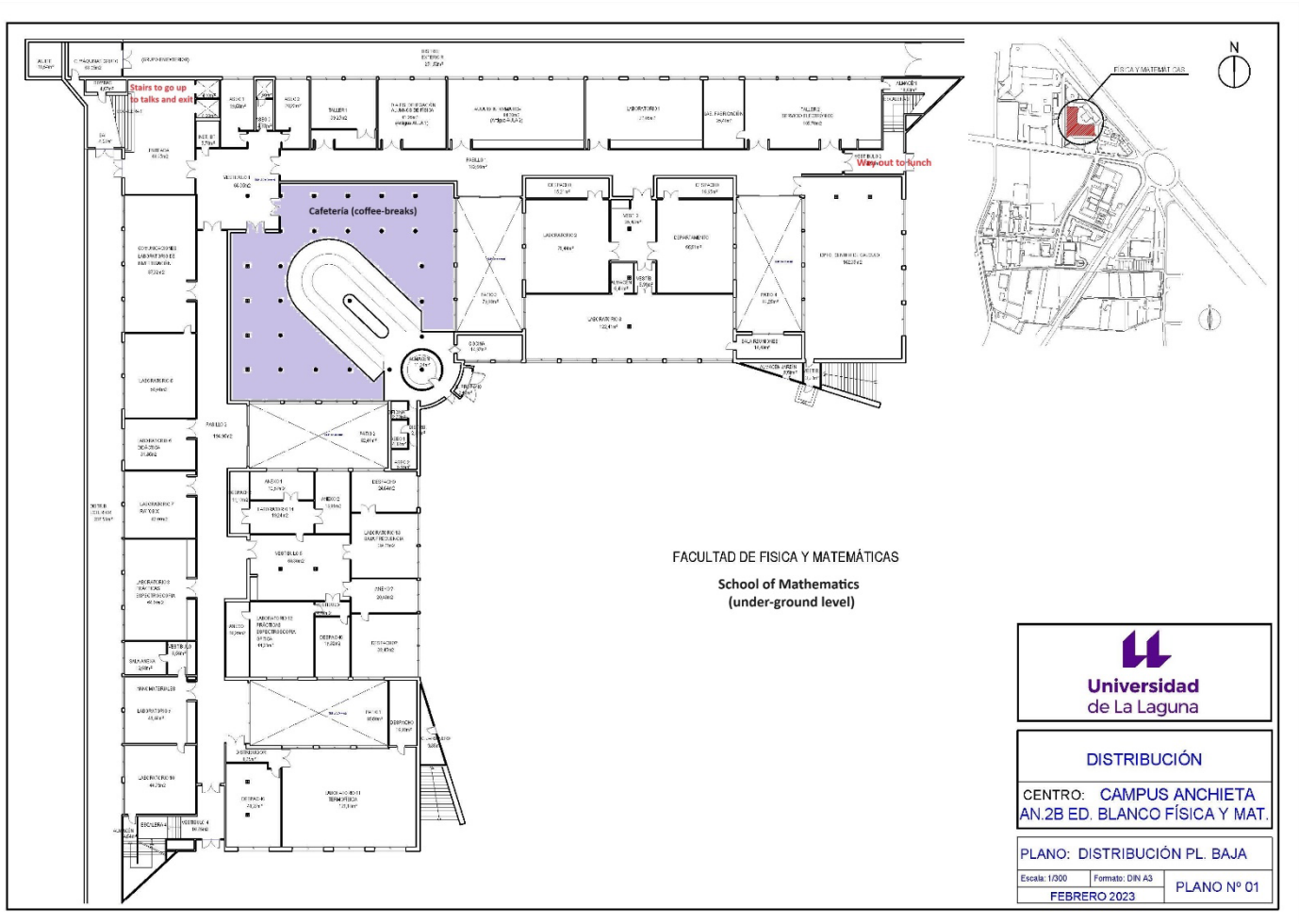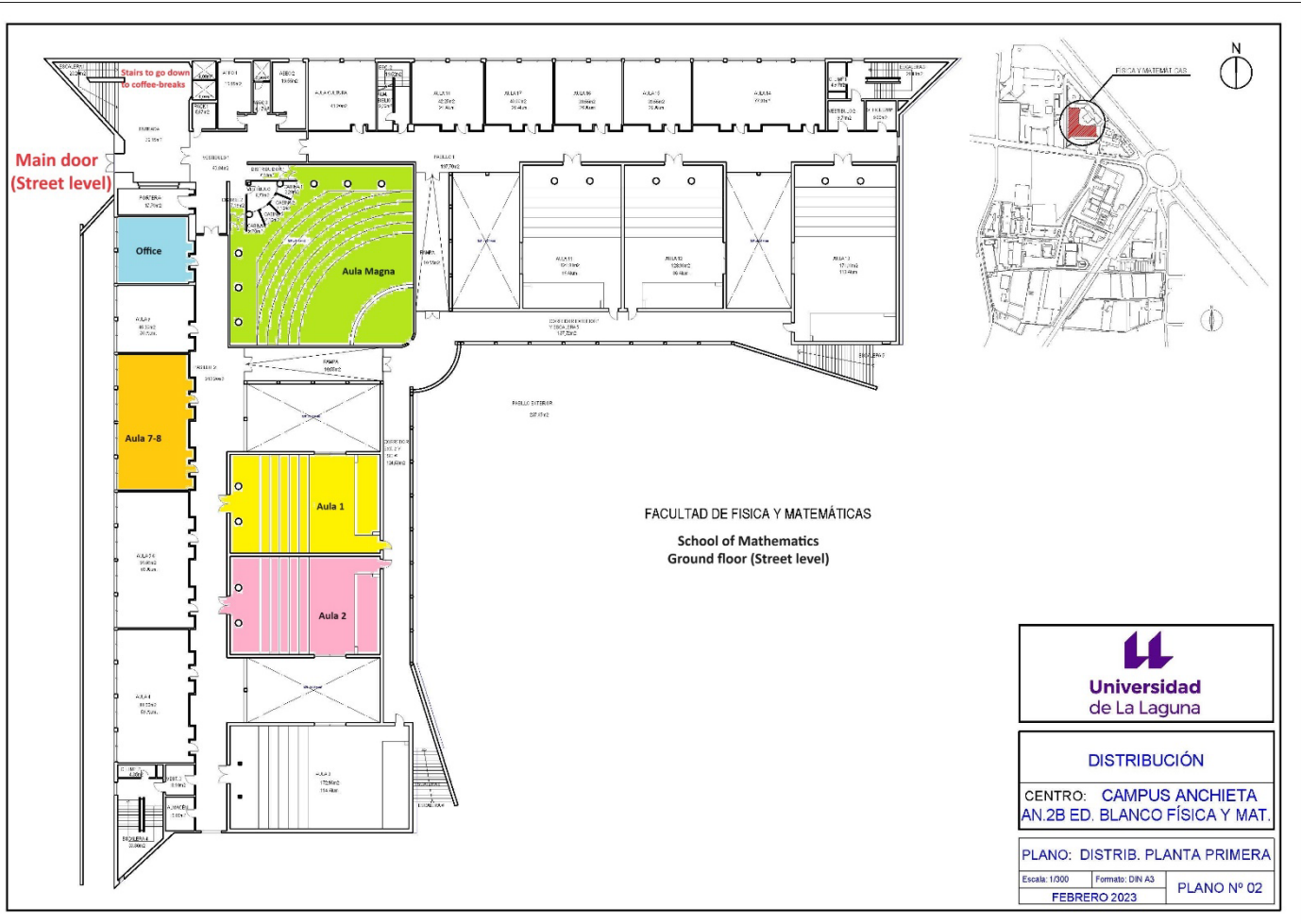

The school (20-21 May 2024) and the Plenary talks (22-24 May 2024) take place in "Aula magna", immediately when you enter the Math building from the main door, at the ground level.

Contributed talks (conference sessions) take place in "Aula 1", "Aula 2" and "Aula 7-8", on the left from main door, also at the ground level.

Coffee-breaks are in the "Cafeteria" in the underground level, thus you must go down stairs from the ground floor. Stairs are on your right from main door.

Lunches will be served in another building, which is "Escuela Superior de Ingeniería Informática", just next to the Math School building. Go downstairs from the ground floor and follow signs. It will take you 3 minutes.

Stairs to go down to coffee-breaks

Main door (Street level)

Office

Aula Magna

Aula 7-8

Aula 1

Aula 2

FACULTAD DE FISICA Y MATEMÁTICAS

School of Mathematics
Ground floor (Street level)

FISICA Y MATEMT. CAR.

Universidad
de La Laguna

DISTRIBUCIÓN

CENTRO: CAMPUS ANCHIETA
AN.2B ED. BLANCO FÍSICA Y MAT.

PLANO: DISTRIB. PLANTA PRIMERA

Escala: 1/300	Formato: DIN A3	PLANO Nº 02
FEBRERO 2023		

Stairs to go up to talks and exit

Way out to lunch

Cafetería (coffee-breaks)

FACULTAD DE FISICA Y MATEMÁTICAS

School of Mathematics
(under-ground level)

Stairs to go down

FISICA Y MATEMT. CAR.

Universidad
de La Laguna

DISTRIBUCIÓN

CENTRO: CAMPUS ANCHIETA
AN.2B ED. BLANCO FÍSICA Y MAT.

PLANO: DISTRIBUCIÓN PL. BAJA

Escala: 1/300	Formato: DIN A3	PLANO Nº 01
FEBRERO 2023		

School program

The conference is on May 22-24 (Wednesday, Thursday, Friday). Before the conference, there will be a two-day school (Monday 20 and Tuesday 21). The school is oriented to graduated students with an interest in Combinatorial Optimization. The school's theme is "Combinatorial Optimization and Machine Learning", with lectures by two well-known experts:

Amitabh Basu (Johns Hopkins University, Baltimore, USA)
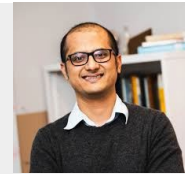
Andrea Lodi (Cornell Tech and Technion, New York, USA)

The ISCO 2024 summer school will focus on the interplay between machine learning and discrete optimization and geometry. On the one hand, we will explore ways that discrete geometry and mixed-integer optimization has helped in machine learning. This will include understanding the structural properties of neural networks such as rigorous depth vs. size tradeoffs, as well as contributing to fundamental ML problems using mixed-integer optimization. On the other hand, we will explore ways to use ML to enhance algorithms for mixed-integer optimization. We will cover both theoretical aspects like rigorous sample complexity bounds for ML approaches to speed up mixed-integer algorithms like branch-and-cut, as well as the ML ideas that have made a difference in practice. We will not assume any background in machine learning theory or practice, and the summer school will be targeted to an audience with a basic background in discrete and combinatorial optimization. We plan to have one of the 2-hour sessions as an interactive session between the summer school lecturers and the participants. We will invite the participants to share problems at the interface of ML and discrete optimization that they have been working with, and also organize a general discussion on concrete open questions, as well as the general future direction of research in this domain.

	Monday 20 May	Tuesday 21 May
08:30-10:30	**lecture M1**	**lecture T1**
10:30-11:00	coffee break	coffee break
11:00-13:00	**lecture M2**	**lecture T2**
13:00-14:00	lunch	lunch
14:00-16:00	**lecture M3**	**lecture T3**
16:00-16:30	coffee break	coffee break
16:30-18:30	**lecture M4**	**lecture T4**
20:00-21:00	Welcome to the school	

Conference program

(plenaries at "aula magna"; contributed sessions at "aula 1", "aula 2", "aula 7-8")

	Wednesday 22 May	Thursday 23 May	Friday 24 May
08:45-09:00	opening		
09:00-09:50	**plenary talk**	**plenary talk**	**plenary talk**
10:00-11:15	**Session W1**	**Session T1**	**Session F1**
11:15-11:45	coffee break	coffee break	coffee break
11:45-13:00	**Session W2**	**Session T2**	**Session F2**
13:00-14:30	lunch	Lunch	lunch
14:30-15:45	**Session W3**	Bus trip to Teide	**Session F3**
15:45-16:15	coffee break	Bus trip to Teide	coffee break
16:15-17:30	**Session W4**	Bus trip to Teide	**Session F4**
18:30-20:00	visit to La Laguna	Bus trip to Teide	
20:00-........	Welcome to the conference		Conference dinner

22 May 2024

Registration desk from 8:00

08:45-09:00	opening	(aula magna)
09:00-09:50	invited speaker	(aula magna)
10:00-11:15	session W1	(aula 1, aula 2, aula 7-8)
11:15-11:45	coffee break	(cafeteria de Matemáticas)
11:45-13:00	session W2	(aula 1, aula 2, aula 7-8)
13:00-14:30	lunch	(cafeteria de Informática)
14:30-15:45	session W3	(aula 1, aula 2, aula 7-8)
15:45-16:15	coffee break	(cafeteria de Matemáticas)
16:15-17:30	session W4	(aula 1, aula 2, aula 7-8)
18:30-20:00	walking with a guide in La Laguna (map)	
20:00-21:00	welcome reception (Museo de Santa Clara)	

23 May 2024

Registration desk from 8:00

09:00-09:50	invited speaker	(aula magna)
10:00-11:15	session T1	(aula 1, aula 2, aula 7-8)
11:15-11:45	coffee break	(cafeteria de Matemáticas)
11:45-13:00	session T2	(aula 1, aula 2, aula 7-8)
13:00-14:30	lunch	(cafeteria de Informática)
14:30-21:00	bus trip to Teide	(Observatorio del Teide)

24 May 2024

Registration desk from 8:00

09:00-09:50	invited speaker	(aula magna)
10:00-11:15	session F1	(aula 1, aula 2, aula 7-8)
11:15-11:45	coffee break	(cafeteria de Matemáticas)
11:45-13:00	session F2	(aula 1, aula 2, aula 7-8)
13:00-14:30	lunch	(cafeteria de Informática)
14:30-15:45	session F3	(aula 1, aula 2, aula 7-8)
15:45-16:15	coffee break	(cafeteria de Matemáticas)
16:15-17:30	session F4	(aula 1, aula 2, aula 7-8)
20:00-23:00	Conference dinner (Casino de La Laguna)	

Social program

Monday 20 May 2024:

Participants registered at the ISCO2024 school are invited to meet together in a **Welcome Reception** at 20:00, Hotel Nivaria, with food and drinks.

Wednesday 22 May 2024:

Starting from Plaza del Adelantado (across Hotel Nivaria) at 18:30, we will walk around streets guided by an expert on the history of San Cristobal de La Laguna. The city was founded between 1496 and 1497 by Alonso Fernández de Lugo and became the capital of the island of Tenerife after the conclusion of the conquest of the islands. Later the city became the capital of all of the Canary Islands. The historic center of the city was declared a World Heritage Site on 2 December 1999. Several streets of historical significance have been closed off to automobile traffic. La Laguna has often been called the «Florence of the Canary Islands», due to its many churches and convents, as well as its old town and historic buildings. *Do not miss this cultural walk!!!*

At 20:00 participants registered to the ISCO2024 conference are welcome to enter the Santa Clara Museum to see an interesting selection of silverware (paintings, chalices, custodies, censers, etc.) from different workshops, mostly American and Canarian, including some produced in La Laguna in the 18th century. In this museum we will have a **Welcome Reception** to the conference with some biscuits homemade by the nuns and a drink, ending at 21:00, a good time for you to go out for dinner on your own in La Laguna.

Thursday 23 May 2024:

We will take buses from outside the building of the Math School between 14:15 and 14:30, just immediately after lunch. They will bring us to the Teide Observatory, managed by *Instituto de Astrofísica de Canarias* (IAC). The bus route will take to one hour going up. Astronomers of the observatory will explain us the main aspects of their on-going research projects and the main astronomic instruments from 16:00 to 17:00.

Later, buses will move us to Las Cañadas del Teide to enjoy together the volcanic landscape with a tourist guide. We plan to be back in La Laguna by 20:00.

Friday 24 May 2024:

The Conference Dinner of ISCO 2024 will be at Casino La Laguna, starting at 20:00. Founded on 22 April 1899, it was a meeting place where political and social issues that directly or indirectly affected the life of the City were discussed. It was a gathering place very typical of the time.

Plenary talks

[Claudia Archetti (ESSEC, Paris, France)](#)   [BIO](#)
"Exploiting Public Transport for Parcel Delivery: The Freight on Transit problem".

The last-mile delivery is the most expensive part of the whole freight delivery process, in addition to being the most unsustainable one. The delivery system affects not only the shipping companies, but urban life as well. There are several stakeholders in the last-mile delivery system, either direct or indirect, who are impacted. The impact caused by vehicles performing deliveries associated with last-mile operations can be three-fold: economic, social and environmental. To keep up with the growing demands and resulting issues caused by e-commerce delivery systems, companies are looking towards innovative approaches that reduce the costs of social and environmental externalities. In this work we consider a delivery system for last-mile deliveries in urban areas based on the use of Public Transport Service, i.e., that combines freight transportation with mass mobility systems. The idea is to use the residual capacity on public transport means for moving freights within the city. In particular, the system is such that parcels are first transported from origins to drop-in stations on public-vehicle itineraries. Then, they are transported by public vehicles to drop-out stations, from where they are delivered to their destination by freighters using green vehicles. The system is known as Freight-On-Transit (FOT). We present optimization problems related to strategic, tactical and operational decision levels, together with proposed solution methodologies and simulations on synthetic data.

[Francisco Barahona (IBM T. J. Watson Research Center, Yorktown Heights, USA)](#)   [BIO](#)
"New Algorithms for Weight Increase of Minimum Spanning Trees and Network Strength".

We investigate the problem of augmenting the weight of all minimum spanning trees in a graph, under the assumption of a linear edge cost for each edge weight increase, and within a fixed budget. This was first studied by Frederickson & Solis-Oba (1999), and later by Juttner (2006). We discuss the previous methodologies, and propose a faster algorithm that uses "Network Reinforcement" as a subroutine. Additionally, we address the question of increasing the strength of a network, defined as the maximum number of disjoint spanning trees. We give an algorithm to increase the strength under a limited budget.

[Jon Lee (University of Michigan, Ann Arbor, USA)](#)   [BIO](#)
"Efficient and effective optimization methods for sparse generalized inverses".

The Moore-Penrose (M-P) pseudo-inverse has a prominent place in matrix theory and applications. It is well-known that the M-P pseudo-inverse is characterized by the four M-P properties. But not all of these properties are needed for the use of it in applications like least-squares fitting. In particular, when a matrix is not full rank, as is common in modern applications, there are much sparser (and even block structured, for explainabilty) generalized inverses than the M-P pseudo-inverse that solve the least-squares problem for arbitrary response vectors. Besides sparsity and structured sparsity, we are interested in low-rank and low-norm solutions, for further explainability and numerical stability. So, we attack the problem of generating such generalized inverses using optimization methods. Our techniques include: linear programming (LP), second-order cone programming (SOCP), local-search based approximation methods, the alternating direction method of multipliers (ADMM), and accelerations of these ideas via new structural results on generalized inverses.

This is joint work with Marcia Fampa, Gabriel Ponte, Luze Xu.

Contributed talks

The school (20-21 May) and the plenary talks by invited speakers (22-24 May) take place at "aula magna", which you find immediately when you enter the Math School building through the main door.

The parallel sessions of the conference (22-24 May) take place in rooms "Aula 1", "Aula 2" and "Aula 7-8" on the ground floor of the Math School building. The are on your right corridor when you enter through the main door.

Instructions for speakers and session chairs in parallel sessions:

• Please make sure you arrive at least 15 minutes before the start of your session in your room ("aula").

• A session consists of three presentations of 25 minutes. Allow 20 minutes for your presentation and 5 minutes for discussion and change of speaker.

• The session chair is the third speaker and keeps track of the time and moderates the talks.

• In case of a no-show, do not continue with the next talk, but wait until the next time slot starts.

• Each room ("aula") is equipped with a desktop and audio visual equipment. To ensure a smooth flow, all presentations will be made from the room desktop. Please bring your presentation slides on a USB-stick, and load them onto the room desktop in advance of your session. Student volunteers will be available to assist. Note that the desktops are wiped each evening, and all presentations in the desktop will be deleted.

[WEB-LINK TO THE TIME SCHEDULE OF ALL TALKS]

Journal publications

The 46 submitted "regular papers" went through a deep referee process, and 30 of them resulted selected (some after a revision) to be published in volume 14594 of *Lectures Notes in Computer Science*, by Springer. These articles are presented by their authors during the conference. The LNCS volume is a pre-conference publication.

As in previous ISCO conference, there is a planned post-conference special issue of *Discrete Applied Mathematics* where research works presented at ISCO 2024 are invited to be submitted for potential publication after the standard referee procedure of the journal.

Thanks to our sponsors