Technical Program

OR@Africa Day – 2nd Edition in ALGERIA
Thursday, 4 December 2025 – 08:15–17:00
Location: Conference Room *Abdelkader Khelladi*, Bloc B, Faculty of Mathematics, University of Science and Technology Houari-Boumediene (USTHB), Algiers

Opening session	08:15-08:30	Opening and Welcome Session
	08:30-09:00	OR@Africa Presentation
Session 1: OR in Algeria	09:00-09:30	Hacène Belbachir
	09:30-10:00	Méziane Aïder
	10:00-10:30	Coffee Break
	10:30-11:00	Sami Nazim
	11:00-11:30	Mohammed Yagouni
	11:30-13 :00	Lunch Break
Session 2: OR at Africa 1	13:00-13:25	Umar Muhammad Modibbo
	13:25-13:50	Latifa Belhocine
	13:50-14:15	Khaled Khayati
	14:15-14:40	Syphax Ait Oubelli
	14:40-15:00	Coffee Break
Session 3: OR at Africa 2	15:00-15:25	M.-Lounes Bentaha
	15:25-15:50	Takouda, Pawoumodom Matthias
	15:50-16:15	Youssouf Hadhbi
	16:15-16:40	A. Ridha Mahjoub
Closed session	16:40-16:55	Sabrina Bentaha
	16:55-17:00	Closing Address

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■ Opening Session

08:15–17:00

1- Opening and Welcome Session
08:15–08:30
Nacera Maachou, ORSC team
Introduction to the event's objectives and a welcome address to attendees

2- OR@Africa Presentation
08:30–09:00
Wissem Ahmed Zaid
Overview of OR@Africa initiatives, achievements, and vision

■ Session 1: OR in Algeria

09:00–11:30
4 presentations. Chair : Mohammed Yagouni

1- Step-constrained self-avoiding walks on finite grids.
09:00–09:30
Hacène Belbachir
The study of self-avoiding walks (SAWs) on integer lattices has been an area of active research for several decades. Our aim is to investigate the number of SAWs between two diagonally opposite corners in a finite rectangular subgraph of the integer lattice, subject to certain constraints. In the two–dimensional case, we present an explicit formula for the number of SAWs of a prescribed length, restricted to three-step directions: up ($\uparrow$), left ($\leftarrow$) considered as the wrong step, and right ($\rightarrow$).. In addition, we develop an algorithm that produces faster computational results than the explicit formula. For some special cases, we present detailed counts of the SAWs in question. For rectangular grid graphs of higher dimensions, we provide a formula to count the number of SAWs that are exactly two steps longer than the shortest walks.

2- Quelques variantes de problèmes de transport en recherche opérationnelle.
09:30–10:00
Méziane Aïder
Les problèmes de transport alimentent l'activité socio-économique dans tous les pays du monde. Ils constituent des modèles essentiels en recherche opérationnelle. Cette présentation se veut être un petit tour d'horizon autour de quelques types de problèmes de transport, avec leurs spécificités, leurs modèles mathématiques et les méthodes utilisées pour leur résolution.

3- **Ordonnancement à échelle moyenne en industrie.**
   10:30–11:00
   Nazim Sami
   Dans de nombreuses entreprises industrielles, la performance globale dépend de la capacité à synchroniser efficacement les activités commerciales et la production. Dans notre cas, un problème d'ordonnancement sur des machines parallèles avec un opérateur a été modélisé et une métaheuristique de type algorithme génétique a été programmée, testée et déployée. Les résultats obtenus ont apporté des gains importants à l'entreprise, ce qui a permis de maximiser l'utilisation des ressources, limiter les pertes et prévenir de potentiels risques.

4- **Métastorming 2.0 : L'Intelligence Collective des Métaheuristiques augmentée par l'IA.**
   11:00–11:30
   Mohammed Yagouni
   Il y a 10 ans, nous introduisions le concept de MetaStorming, un paradigme nouveau de coopération et de collaboration des méthodes d'optimisation métaheuristique. Aujourd'hui, l'IA nous permet de passer de la simple collaboration à une véritable intelligence collective. Je présenterai dans cette conférence l'évolution du MetaStorming...

■ Session 2: OR at Africa 1

13:00–14:40
   4 presentations. Chair : Syphax Ait Oubelli

1- **The Role of Artificial Intelligence (AI) in Mathematical Sciences and Information Systems.**
   Umar Muhammad Modibbo
   13:00-13:25
   This presentation delves into the profound influence of Artificial Intelligence (AI) on Mathematical Sciences, highlighting its revolutionary role in reshaping research methodologies. Through the synergy of machine learning algorithms and data-driven insights, AI empowers researchers to address intricate problems with unparalleled efficiency and precision. Key areas of focus include AI's application in optimising simulations, predicting outcomes, and revealing concealed patterns within complex systems. The fusion of AI with conventional computational techniques is unlocking fresh research and innovation pathways, while also prompting crucial discussions on interpretability, reliability, and ethics.

2- **Towards an environmentally and economically efficient reconditioning of electronic products.**
   13:25-13:50
   Latifa Belhocine
   The remanufacturing process is recognized for its effectiveness in managing environmental issues of end-of-life products. Increasingly more companies specialize in remanufacturing various products, extending their lifespan while reducing manufacturing costs. This study focuses on managing Waste Electrical and Electronic Equipment (WEEE) through remanufacturing, with particular emphasis on smartphones. We study a problem integrating all remanufacturing process steps: recovery, transport, and remanufacturing operations for customers using similar product types over a given horizon. The problem involves planning the recovery of used products for remanufacturing operations and grade improvement under available stock constraints. Key decisions concern: (1) customer selection for recovery and product replacement, (2) transport

optimization for used product recovery, and (3) specification of quality grades to be achieved after remanufacturing. The objective aims to minimize economic and environmental costs. We introduce a new product performance index calculated based on component performance. Since each component's performance decreases with usage frequency, we define user profiles that model the impact of user behavior on product performance. A detailed mathematical model is developed with a multi-objective solution approach based on NSGA-II (Non-dominated Sorting Genetic Algorithm). We perform sensitivity analysis and multi-criteria decision analysis using TOPSIS, with the approach validated on multiple problem instances. This framework provides a comprehensive solution for sustainable WEEE management through optimized remanufacturing processes.

3- Stochastic Programming for Job Sequencing and Tool Switching Problem with Non-Identical Parallel Machines and Stochastic Processing Times.
13:50-14:15
Khaled Khayati
This presentation focuses on a scheduling problem that combines job sequencing and tool switching on non-identical parallel machines under uncertain processing times. We introduce a single-stage stochastic MILP that builds on an Improved Position-based MILP, reducing timing dependencies and simplifying sequence propagation. Processing times follow scenario-based Normal distributions. Experiments on benchmark instances demonstrate that the proposed model yields an expected makespan equal to or better than that of existing data-driven approaches. It also achieves important reductions in computational time, especially on medium and large problem sizes. The results highlight the potential of stochastic programming for complex manufacturing scheduling problems.

4- Solving employee scheduling using Python OR-Tools
14:15-14:40
Syphax Ait Oubelli
Employee scheduling is the art of assigning the right people to the right shifts, while respecting availabilities, preferences, staffing needs… A complex problem that workforce managers regularly spend hours trying to solve manually, without much success, given the large sea of possibilities. This is where Operations Research comes in, with its various techniques to handle such problems. Learn about different possible real-world scenarios, how to model them mathematically, and how to use Python and OR-Tools framework to implement modern solutions that automate this process.

■ Session 3: OR at Africa 2
15:00–16:40
4 presentations. Chair: Bentaha, M.-Lounes

1- Management of uncertainty in disassembly systems based on stochastic programming.
15:00-15:25
M.-Lounes Bentaha
Disassembly systems, unlike their assembly counterparts, are subject to multiple sources of uncertainty. These uncertainties arise from factors such as stochastic demand, heterogeneous quality states of end-of-life (EoL) products, variability in task processing times, and the potential presence of hazardous materials. Efficient operation of disassembly systems requires addressing these uncertainties across strategic (e.g., system design), tactical (e.g., system reconfiguration,

workload balancing), and operational (e.g., shop-scheduling) decision levels. This work demonstrates the effectiveness of stochastic programming as a decision-aiding tool to tackle uncertainty in disassembly systems. Proposed stochastic models focus particularly on the strategic and tactical dimensions.

2- Beyond Traditional Metrics: DEA-Based Financial Inclusion Performance Measurement in West Africa.
15:25-15:50
Takouda Pawoumodom Matthias, Mohamed Dia, Alassane Ouattara
This study applies Data Envelopment Analysis (DEA) to assess financial inclusion across West African Economic and Monetary Union countries (2010-2017). Results show steady regional improvement with heterogeneous performance, and identifies benchmark countries. DEA demonstrates superior discrimination compared to traditional methods, while mobile money emerges as a key driver of inclusion.

3- Next-Generation of Operations Research: Advancing with AI to Deliver Innovative Solutions.
15:50-16:15
Youssouf Hadhbi
This talk explores the evolving relationship between Operations Research (OR) and Artificial Intelligence (AI), highlighting their historical independence and recent synergies. It discusses how AI techniques, such as machine learning and data-driven algorithms, are increasingly integrated into OR to enhance decision-making and optimization. By viewing OR and AI as interconnected fields, we underscore the potential for leveraging their combined strengths to develop innovative solutions across various industries.

4- Structural Analysis for Conditional-Algebraic Systems, and Combinatorial Optimization.
16:15-16:40
A. Ridha Mahjoub
Differential-Algebraic Systems (DAS) are used for modeling complex physical systems such as electrical networks and dynamic movements. Such a system can be given as $F(x,x',t)=0$ where x is the variable vector, t the time and x' the derivative vector associated to x with respect to time. In many practical situations, physical systems may have different states generated by some technical conditions. These may be, for instance, related to temperature changment. Such systems generally yield conditional DASs which may have different states depending on the assignment of the true and false values to the conditions. Each assignment yields a non-conditional system called a state of the system. A main problem, which arises in the analysis of DASs, is to know whether or not the system may have a solution in each state, and if not to determine a state in which the system has no solution. This is called the Structural Analysis Problem. In this talk, we consider this problem. We give an integer programming formulation for the problem. This is based on a transformation of the problem into a matching problem in an auxiliary graph. We show that the linear relaxation can be solved in polynomial time. We also describe some valid inequalities. Using this, we will discuss a Branch-and-Cut algorithm for the problem along with some experimental results.

■ Closed session

16:40–17:00

1- Honor guest: ALGODECISION
16:40-16:55
<u>Sabrina Bentaha</u>
Créée en juin 2025, développe des solutions d'aide à la décision et d'optimisation, ainsi que des outils de valorisation de données tels que dashboards et bases de données. Elle réalise également des études, du conseil et de la formation en informatique, mathématiques, modélisation et innovation technologique. L'entreprise manifeste un intérêt particulier pour la promotion de la Recherche Opérationnelle (RO) en Afrique, notamment en Algérie, où elle souhaite contribuer au développement et à la diffusion de ces approches.

2- Closing Address
16:55–17:00