

IMA and OR Society Conference on Mathematics of Operational Research
Innovating Mathematics for New Industrial Challenges
20 - 21 April 2017, Aston University, Birmingham, UK

PROGRAMME

Thursday 20 April 2017

Thursday	08:30	09:00	09:50	10:00	10:30	11:00	11:15	11:45	12:15	12:45	13:15	13:45	14:15	14:45	15:15	15:45	16:15	16:45	17:20	17:50	18:20	18:50	
Main Room	Registration		Welcome	Plenary I: Celia Yabar Valles		Break	Mathematical Optimization in Data Science I				Lunch		Plenary II: Professor Bert Zwart		Break	Mathematical Optimization in Data Science II			Recent advances in financial optimisation		Posters and Drinks Reception (sponsored by The Smith Institute)		
R1	Coffee/Tea on arrival						Stochastic Optimal Control, Theory and Applications I																
R2							Integer Optimisation										Network Design and Transportation						
R3																Applications of Discrete Optimisation I/II							
R4							Algorithmic Game Theory										Theory and Application of Mathematical Optimisation						20:00 Dinner plus after dinner speaker - Ruth Kaufman (President of OR Society)
R5							Optimization under Strategic and Informational Uncertainty										Conic Optimization and Applications in OR I/II						
R6							Optimisation and Learning for Allocation of Resources over Time									Resource allocation with Fairness Constraints		Optimisation, uncertainty and multiple objectives					
R7							Nonlinear and Bilevel Optimisation									Revenue Management							

Thursday 20 April 2017

MR	<p>10:00 – 11:00</p> <p>Plenary I: Celia Yabar Valles (European Space Agency) - <i>The role of mathematical optimization for ESA space missions: cases and challenges</i> Chair: Joerg Fliege</p>	<p>14:15 – 15:15</p> <p>Plenary II: Professor Bert Zwart (CWI Amsterdam) <i>Reliability of energy networks</i> Chair: Kevin Glazebrook</p>	
	<p>11:15 – 13:15</p>	<p>15:45 – 17:15</p>	<p>17:20 – 18:50</p>
MR	<p>Mathematical Optimization in Data Science I Session organisers: Dolores Romero Morales & Emilio Carrizosa</p> <p><i>GOTCHA! Network-based Fraud Detection for Social Security Fraud</i> Bart Baesens (KU Leuven and University of Southampton)</p> <p><i>A Partial Parametric Path Algorithm for Multi-Class Classification</i> Belén Martín Barragán (University of Edinburgh)</p> <p><i>Support Vector Machines with asymmetric costs</i> Emilio Carrizosa (Universidad de Sevilla)</p> <p><i>Data support for algorithm development</i> Patrick De Causmaecker (KU Leuven)</p>	<p>Mathematical Optimization in Data Science II Session organisers: Dolores Romero Morales & Emilio Carrizosa</p> <p><i>Learning how to decompose</i> Markus Kruber (University of Aachen)</p> <p><i>Visualizing data as objects by DC (difference of convex) optimization</i> Dolores Romero Morales (Copenhagen Business School)</p>	<p>Recent advances in financial optimisation Session organiser: Ralf Werner</p> <p><i>Efficient membership testing for the correlation polytope by column generation</i> Jonas Schwinn (Augsburg University)</p> <p><i>Calibration of the Nelson-Siegel and the Svensson model</i> Ralf Werner (Augsburg University)</p> <p><i>An RBF Method for Noisy Global Optimisation with Applications to Financial Model Calibration</i> Dirk Banholzer (University of Southampton)</p>

R1	<p>Stochastic Optimal Control, Theory and Applications I Session organiser: Alexey Piunovskiy</p> <p><i>A Functional Analytic Approach to Approximate Iterative Algorithms</i> Anthony Almudevar (University of Rochester)</p> <p><i>The Expected Total Reward Criterion for Markov Decision Processes</i> Francois Dufour (INRIA Bordeaux Sud Ouest)</p> <p><i>Realizable Strategies in Continuous-Time Markov Decision Processes</i> Alexey Piunovskiy (University of Liverpool)</p> <p><i>Stochastic control strategies applied to a pricing problem in retail</i> Asbjørn Nilsen Riseth (University of Oxford)</p>	<p>Stochastic Optimal Control, Theory and Applications II Session organiser: Alexey Piunovskiy</p> <p><i>Optimization of Caching Devices with Geometric Constraints</i> Konstantin Avrachenkov (INRIA Sophia-Antipolis)</p> <p><i>Gesture Recognition using Inertial Sensors - Optimized HMM Approach</i> Alexander Zadorojnyi (IBM Research)</p>	
R2	<p>Integer Optimisation Session organiser: Iskander Aliev</p> <p><i>The Clique Partitioning Problem: Facets from Gadgets</i> Adam Letchford (Lancaster University)</p> <p><i>Centerpoints: A link between optimization and convex geometry</i> Timm Oertel (Cardiff University)</p> <p><i>Integrality gaps of integer knapsack problems</i> Iskander Aliev (Cardiff University)</p>	<p>Network Design and Transportation Session organiser: Kerem Akartunali</p> <p><i>Solutions of Multi-Period Network Design Problems</i> Ioannis Fragkos (Erasmus University)</p> <p><i>Vessel Crew Scheduling: Formulations and Heuristics</i> Seda Sucu (University of Strathclyde)</p> <p><i>MIP Modeling of Incremental Connected Facility Location</i></p>	

	<p><i>Improving Linear Relaxations of Mixed-Integer Quadratic Programs via Bit Representation</i> Laura Galli (University of Pisa)</p>	<p>Ashwin Arulsevan (University of Strathclyde)</p>	
R3		<p>Applications of Discrete Optimisation I</p> <p><i>Lexicographic optimisation for rescheduling</i> Dimitrios Letsios (Imperial College London)</p> <p><i>Reliability Network Design for an Aircraft Door Management System</i> Lukas Schaefer (University of Edinburgh)</p> <p><i>A Mixed-Integer Model for Skill Development in a Multi-Skilled Workforce</i> Alice Robins (University of Southampton)</p>	<p>Applications of Discrete Optimisation II</p> <p><i>A two-level graph partitioning problem arising in mobile wireless communications</i> Jamie Fairbrother (University of Lancaster)</p> <p><i>A Lagrangean relaxation based heuristic for the simple plant location problem with customers' preferences</i> Xavier Cabezas and Sergio García (University of Edinburgh)</p>
R4	<p>Algorithmic Game Theory Session organiser: Gregory Sorokin</p> <p><i>Analysis of a Procurement Game with Option Contracts</i> Bo Chen (University of Warwick)</p> <p><i>The assignment game: Decentralized dynamics, rate of convergence, and equitable core selection</i> Bary Pradelski (ETH Zurich)</p> <p><i>VCG auction mechanism cost expectations and variances</i></p>	<p>Theory and Application of Mathematical Optimisation Session organiser: Gregory Sorokin</p> <p><i>Rescaled first-order methods for Linear Programming</i> Daniel Dadush (CWI Amsterdam)</p> <p><i>Polynomial-time rescaled coordinate-descent methods for submodular function minimization</i> Giacomo Zambelli (London School of Economics and Political Science)</p> <p><i>Punch and die manufacturing optimisation for</i></p>	

	<p>Gregory Sorkin (London School of Economics and Political Science)</p> <p><i>Welfare guarantees for sequential posted pricing</i></p> <p>Thomas Kesselheim (MPI Saarbruecken)</p>	<p><i>multilayer ceramic modules (MLCs)</i></p> <p>Gregory Sorkin (London School of Economics and Political Science)</p>	
R5	<p>Optimization under Strategic and Informational Uncertainty</p> <p>Session organiser: Felix Fischer</p> <p><i>Best-Response Dynamics in Combinatorial Auctions with Item Bidding</i></p> <p>Thomas Kesselheim (Max-Planck-Institut für Informatik)</p> <p><i>Optimal Auctions with Restricted Valuations</i></p> <p>Ian Kash (Microsoft Research)</p> <p><i>Hiring Secretaries over Time</i></p> <p>Max Klimm (HU Berlin)</p> <p><i>Online Resource Minimization</i></p> <p>Nicole Megow (Universität Bremen)</p>	<p>Conic Optimization and Applications in OR I</p> <p>Session organiser: Michal Kocvara</p> <p><i>MOSEK Fusion: A tool for formulating and solving conic optimization problems</i></p> <p>Erling Andersen (MOSEK)</p> <p><i>SDP bounds for the quadratic shortest path problem</i></p> <p>Renata Sotirov (University of Tilburg)</p> <p><i>Semidefinite Relaxations for some Graph Problems based on the Exact Subgraph Idea</i></p> <p>Franz Rendl (University of Klagenfurt)</p>	<p>Conic Optimization and Applications in OR II</p> <p>Session organiser: Michal Kocvara</p> <p><i>Second Order Cone Programs for Constrained Optimization without Using Derivatives</i></p> <p>Florian Jarre, Felix Lieder (University of Duesseldorf)</p> <p><i>Locally Linear Embedding for Metric Dissimilarities</i></p> <p>Houduo Qi (University of Southampton)</p> <p><i>Low-rank matrix recovery with Ky Fan 2-k-norm</i></p> <p>Vinh Doan (University of Warwick)</p>
R6	<p>Optimisation and Learning for Allocation of Resources over Time</p> <p>Session organiser: Peter Jacko</p> <p><i>Dynamic control of birth-and-death restless bandits: application to resource-allocation problems</i></p> <p>Maialen Larrañaga (Laboratory of Signals and</p>	<p>Resource allocation with Fairness Constraints</p> <p>Session organiser: Alec Morton</p> <p><i>Resource allocation with Fairness Constraints</i></p> <p>Nikolaos Argyris (Loughborough University, UK), Ozlem Karsu (Bilkent University, Turkey) Alec Morton (University of Strathclyde, UK, University</p>	<p>Optimisation, uncertainty and multiple objectives</p> <p>Session organiser: Matthias Ehrgott</p> <p><i>New Results on Robust Optimisation with Variable-Sized Uncertainty</i></p> <p>Marc Goerigk (Lancaster University), André Chassein</p> <p><i>Uncertain Data Envelopment Analysis</i></p>

	<p>Systems)</p> <p><i>A Bayesian Adaptive Design for Clinical Trials in Rare Diseases</i> Peter Jacko (Lancaster University)</p> <p><i>Advances in Fully Sequential Clinical Trials</i> Stephen Chick (INSEAD, France)</p>	<p>of Science and Technology of China, China)</p> <p><i>Allocation rules for global donors</i> Alec Morton, Ashwin Arulsevan (Strathclyde University), Ranjeeta Thomas, Peter C Smith (Imperial College)</p> <p><i>Decision support for choosing among projects: handling multi-dimensional efficiency and equity concerns</i> Ozlem Karsu, Nur Kaynar (Bilkent University, Turkey)</p>	<p>Matthias Ehrgott (Lancaster University), Alan Holder, Omid Nohadani</p>
R7	<p>Nonlinear and Bilevel Optimisation Session organisers: Stefano Coniglio & Alain Zemkoho</p> <p><i>A general-purpose solution framework for mixed-integer bilevel linear problems</i> Markus Sinnl (University of Vienna)</p> <p><i>Newton Method for Bilevel Optimization</i> Alain Zemkoho (University of Southampton)</p> <p><i>Convex separation from convex optimization for large-scale problems</i> Steve Brierley (University of Cambridge, DAMTP)</p>	<p>Revenue Management Session organiser: Christine Currie</p> <p><i>Dynamic Booking Control for Car Rental Revenue Management: A Decomposition Approach</i> Dong Li (University of York)</p> <p><i>Optimal Pricing for Vehicle Ferries: Combining Pricing and Packing</i> Christine Currie (University of Southampton), Antonio Martinez Sykora, Christopher Bayliss, Julia Bennell, Mee-Chi So</p> <p><i>Exploration and exploitation in a non-stationary environment</i> Andrea Ellina, Christine Currie and Christophe Mues (University of Southampton)</p>	

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Main Room	Plenary III: Professor Jacek Gondzio		Break	Posters	Cooperative game theory: algorithms and applications				Break	Plenary IV: Professor Edward Kaplan		Lunch						Close			
R1					Mathematical OR and Healthcare I									Mathematical OR and Healthcare II							
R2					Discrete Algorithms												Applications of Dynamic Programming and Queuing				
R3					Simulation and Data Science												Security / Defence				
R4					Airport and Air Traffic Optimization												Statistical learning in STOR-i				
R5					Semi-infinite optimization strategies and robust design												Applications of OR				
R6					OR and Energy Systems												Transportation and Traffic				
R7					Last Mile Deliveries												Flexibility, Specialization and Pooling: Theory, Applications and Future Research				

Friday 21 April 2017

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MR	<p>08:30 – 09:30</p> <p>Plenary III: Professor Jacek Gondzio (University of Edinburgh) <i>Continuation in Optimization: From interior point methods to Big Data</i> Chair: Joerg Fliege</p>	<p>12:30 – 13:30</p> <p>Plenary IV: Professor Edward Kaplan (Yale School of Management) <i>Terror queue staffing and the detection of terror plots</i> Chair: Kevin Glazebrook</p>
	10:15 – 12:15	14:30 – 16:30
MR	<p>Cooperative game theory: algorithms and applications Session organiser: Tri-Dung Nguyen</p> <p><i>Weighted nucleoli and dually essential coalitions</i> Tamás Solymosi (University of Budapest)</p> <p><i>A new algorithm for computing the (pre)nucleolus of general cooperative games</i> Marton Benedek (University of Southampton)</p> <p><i>Finding the nucleolus of any n-person cooperative game by a single linear program</i> Justo Puertoa and Federico Perea</p> <p><i>Cooperative game theory: emerging applications and new research directions.</i> Tri-Dung Nguyen (University of Southampton)</p>	
R1	<p>Mathematical OR and Healthcare I Session organiser: Vince Knight</p> <p><i>A Matheuristic Approach for Scheduling Surgical Procedures</i> Ahmed Kheiri</p>	<p>Mathematical OR and Healthcare II Session organiser: Vince Knight</p> <p><i>Modelling Intensive Care</i> Dandan Shi, Honora Smith, Christine Currie, Matthew Thomas, Christopher Bourdeaux, Navid Izady</p>

	<p><i>Emergency units and time dependent queueing games</i> Vince Knight</p> <p><i>Mathematical Programming for Clustering - Applications and Challenges in Healthcare</i> Daniel Gartner</p> <p><i>OR to support Health Protection Policy</i> Martin Utley</p>	<p><i>Queueing networks, deadlock and healthcare</i> Geraint Palmer</p> <p><i>Rethinking Healthcare: the opportunity and challenge for OR</i> John Bolton</p> <p><i>Modelling Counterfactuals</i> David Worthington</p>
R2	<p>Discrete Algorithms Session organier: László Végh</p> <p><i>Reordering Buffer Management in Trees and General Metric Spaces</i> Matthias Englert (University of Warwick)</p> <p><i>Making Banaszczyk's Bound Constructive for the Komlos Problem</i> Daniel Dadush (CWI, Amsterdam)</p> <p><i>Decomposable Submodular Function Minimization: Discrete and Continuous Approaches</i> László Végh (London School of Economics)</p>	<p>Applications of Dynamic Programming and Queuing</p> <p><i>Approximating Optimal Policies for Routing Problems in Queueing Systems</i> Rob Shone (University of Lancaster)</p> <p><i>Repairable Stocking and Expediting in a Fluctuating Demand Environment: Optimal Policy and Heuristics</i> Joachim Arts, Rob Basten, Geert-Jan Van Houtum (Eindhoven University of Technology)</p> <p><i>Dynamic Pricing of Flexible Time Slots for Attended Home Delivery Services</i> Yijun Zheng, Nalan Gulpinar, Arne Strauss (University of Warwick)</p> <p><i>Queueing Modeling of M/G/1 Fault Tolerant System with Threshold Recovery and Imperfect Coverage</i> Madhu Jain and Rakesh Kumar Meena (IIT Roorkee)</p>
R3	<p>Simulation and Data Science</p> <p><i>Detecting Bias due to Input Modelling in Computer Simulation</i> Lucy Morgan (Lancaster University)</p>	<p>Security / Defence Session organiser: Colin Irwin</p> <p><i>Analyses of the impact of Cyber Defence investments using a Rule Based Fuzzy Cognitive Map</i></p>

	<p><i>Deterministic Simulation and Graphical Representation of Powered Material Handling Vehicle Movements to Enhance Pedestrian Safety</i> Michael Higgins (Ford)</p> <p><i>Utilising transferable hierarchical information for promotional sales forecasting at sku-store level</i> Daniel Waller (Lancaster University)</p>	<p>Pawel Zdanowicz, Dobrila Petrovic (Coventry University), Colin Irwin (UK Ministry of Defence)</p> <p><i>Combating the Dominoes Effect in Defence Asset Schedule Maintenance</i> Nira Chamberlain, Kevin Storer (Babcock Analytics Solutions)</p> <p><i>Monotone Optimal Threshold Feedback Policy for Sequential Weapon Target Assignment</i> Krishna Kalyanam (Infoscitex Corporation)</p>
R4	<p>Airport and air traffic optimization Session organiser: Michael Epitropakis</p> <p><i>Heuristic search for the coupled runway sequencing and taxiway routing problem</i> Una Benlic (Queen Mary University London), Alexander Brownlee (University of Stirling) and Edmund Burke (Queen Mary University London)</p> <p><i>Mathematical Models for Optimizing Trajectory Based Operations (TBO)</i> Konstantinos G. Zografos, Guglielmo Lulli, and Franklin Fomeni (Lancaster University Management School)</p> <p><i>A heuristic algorithm for Air Traffic Flow Management under the TBO concept</i> Veronica Dal Sasso, Guglielmo Lulli, Konstantinos Zografos (Lancaster University)</p> <p><i>Airport slot scheduling decisions through evolutionary multi-objective algorithms: An initial study</i> Michael Epitropakis and Konstantinos Zografos (Lancaster University Management School)</p>	<p>Statistical learning in STOR-i Session chair: Kevin Glazebrook</p> <p><i>Quantifying the Value of Exploration in Bayes Sequential Decision Problems</i> James Edwards</p> <p><i>Patrolling borders with Combinatorial Multi-Armed Bandits</i> James Grant</p> <p><i>Regression over Reproducing Kernel Hilbert Spaces</i> Stephen Page</p> <p><i>Optimistic Planning for the Stochastic Knapsack Problem</i></p>

R5	<p>Semi-infinite optimization strategies and robust design Session organiser: Matthias Gerdt and Markus Zimmermann</p> <p><i>Equality Constraints in Discretization Methods for Bilevel and Generalized Semi-Infinite Programming</i> Hatim Djelassi, Moll Glass, Alexander Mitsos (RWTH Aachen)</p> <p><i>Stochastic two-dimensional decomposition of high-dimensional solution spaces for robust design</i> Tröndle (Uni Basel), Harbrecht (Uni Basel), Zimmermann (BMW)</p> <p><i>Computing mixed solution-compensation spaces for robust design</i> Vogt (TU München), Duddeck (TU München), Wahle (BMW), Zimmermann (BMW)</p> <p><i>Optimizing relaxed solution spaces</i> Lange (TU München), Duddeck (TU München), Fender (BMW)</p>	<p>Applications of OR</p> <p><i>Mathematic Modelling and Optimization of bank Asset and Liability by using Fractional Goal programing Approach</i> S. M. E. Pourmohammad Azizi, A. Neisy, R. Ghasempour (Allameh Tabataba'i University)</p> <p><i>A robust asset–liability management framework for investment products with guarantees</i> Nalan Gulpinar (The University of Warwick)</p> <p><i>Ensemble Methods in Machine Learning: An Algorithmic Approach to Derive Distinctive Behaviors of Criminal Activity Applied to the Poaching Domain</i> Zachary Blanks and Solomon Y. Sonya (United States Air Force Academy Colorado Springs)</p> <p><i>How to identify experts?</i> Balázs Sziklai (Hungarian Scientific Academy)</p>
R6	<p>OR and Energy Systems Session organiser: Stan Zachary</p> <p><i>Operating water distribution networks with on-site wind generation</i> Ruben Menke, Panos Parpas, Ivan Stoianov (Imperial College London) Hercules Vladimirou (University of Cyprus)</p> <p><i>Assessing the value of energy storage</i> Lisa Flatley (Warwick University)</p> <p><i>A Stabilised Scenario Decomposition Algorithm Applied to Stochastic Unit Commitment Problems</i> Tim Schulze, Andreas Grothey and Ken McKinnon (University of</p>	<p>Transportation and Traffic</p> <p><i>Maintenance Location Routing for Rolling Stock: Robust and Stochastic Programming Formulations</i> Denise Tonissen (TU/e)</p> <p><i>Vehicle Routing at a Food Service Marketplace</i> Kavitha Chetana Didugu, Chetan Soman (Indian Institute of Management Ahmedabad)</p> <p><i>Feasibility study of switching from a periodic to a non-periodic risk-based inspection style for rail track maintenance</i> Mohd Haniff B. Osman (University of Birmingham and Universiti Kebangsaan) Sakdirat Kaewunruen, Anson Jack (University of Birmingham)</p>

	<p>Edinburgh)</p> <p><i>Minimizing heat loss in energy networks using batteries</i> Alessandro Zocca and Bert Zwart (CWI Amsterdam)</p>	
R7	<p>Last Mile Deliveries Session organiser: Arne Strauss</p> <p><i>Defining Value in Value-based Order Acceptance for Attended Deliveries</i> Catherine Cleophas, Magdalena Lang (RWTH Aachen University), Jan Fabian Ehmke (Freie Universität Berlin)</p> <p><i>Consolidating Last-mile Transportation Flows in Multi-Channel Retail</i> Niels Agatz, Joydeep Paul, Remy Spliet (Erasmus University Rotterdam)</p> <p><i>Revenue Management Approaches to Manage Demand in Attended Home Delivery</i> Claudius Steinhardt (Bundeswehr University Munich), Jochen Mackert (University of Augsburg)</p> <p><i>An Approximate Dynamic Programming Approach to Attended Home Delivery Management</i> Xinan Yang (University Essex), Arne Strauss (University of Warwick)</p>	<p>Flexibility, Specialization and Pooling: Theory, Applications and Future Research Session organiser: Navid Izady</p> <p><i>Reconfiguring Accident and Emergency Healthcare Facilities</i> Houyuan Jiang (University of Cambridge), ManMohan S. Sodhi (City University London)</p> <p><i>Flexibility in hospital capacity: a queueing approach</i> Rene Bekker (Vrije Universiteit Amsterdam)</p> <p><i>The efficient and flexible hospital: reality or myth?</i> Tom Monks (University of Southampton)</p> <p><i>An Overflow Configuration of Inpatient Beds in Hospitals</i> Navid Izady (City University of London) Israa Mohamed (Zagazig University)</p>

List of Posters

Chemical Biological Radiological and Nuclear Operational Analysis (CBRN OA)

Ann Steptoe (DSTL)

Optimal Policies for Dual-Speed Search Problems

Jake Clarkson (Lancaster University)

Optimisation of Radio Frequency Spectrum

Dr Jakob Blaavand and Dr Claudia Centazzo (Smith Institute)

Symbiotic Simulation in an Airline Operations Environment

Luke Rhodes-Leader (This work is a partnership between the University of Lancaster, Northwestern University and Rolls Royce)

Supporting the design of Radiotherapy Treatment Planning using data envelopment analysis and robust optimisation

Emma Stubington (Lancaster University)

Characteristics of Greek Mutual Fund Managers. An empirical investigation before and during the Economic Adjustment Program for Greece

George Kaimakamis (Alexandros Koulis, Christina Beneki, (Technological Institute of Ionian Islands) and George Kaimakamis (Hellenic Army Academy)

Modelling patient flow and outcomes with community healthcare - a fluid flow approximation of a stochastic queueing system

Ryan Palmer (University College London)

Optimization Models for Slot Allocation at Congested Airports

Jamie Fairbrother (Lancaster University)

Operational Metocean Risk Management under Uncertainty

Toby Kingsman, Burak Boyaci, Jonathan Tawn (Lancaster University)

Optimising Aircraft Engine Maintenance Scheduling Decisions

David Torres Sánchez (Lancaster University)

The Development and Use of Distributed Simulation in the Nuclear Industry

Jacqueline Bishop (Sellafield)

A multi-objective time-and-load-dependent vehicle routing problem with multiple trips and flexible departure times and paths

Ramin Raeesi and Konstantinos G. Zografos (Lancaster University Management School)

Urban transir routing problem optimisation using MOE framework and hyper-heuristics

Leena Ahmed (Cardiff University)

Modelling Operational Delays at Airports

Rob Shone (Lancaster University)

Mathematical Programming for Optimizing the Mix of Reusable and Disposable Endoscopes in Hospitals

Daniel Gartner (Cardiff University), Günther Edenharter and Dominik Pförringer (Technische Universität München)

This conference is supported by the Smith Institute

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