



GIMC SIMAI Young 2024

Napoli, Italy, July 10-12, 2024

Book of Abstracts



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Welcome

Dear Participants,

welcome to Napoli and to the GIMC SIMAI Young 2024 Conference. This conference, held at the University of Naples Federico II in Palazzo della Facoltà d'Ingegneria, Piazzale Tecchio, from July 10th to 12th, 2024, serves as a vibrant platform for young researchers and scholars (aged ≤ 35) to exchange their latest findings, stay abreast of emerging trends, and cultivate meaningful interactions within the realms of applied mathematics and computational mechanics.

The program of this year's conference features a rich array of activities, including plenary lectures by esteemed researchers in the field of Computational Mechanics and Applied Mathematics, a special session dedicated to young promised selected by the GIMC and SIMAI delegates, and a series of thematic sessions organized by participants that collect a total of 175 contributions covering diverse areas of research.

The contributions span across various thematic areas, reflecting the breadth and depth of contemporary research in applied mathematics and computational mechanics. These areas include, but are not limited to, mathematical modeling for socio-epidemiological dynamics, efficient numerical methods for evolutionary partial differential equations, multi-scale approaches and machine learning techniques in material modeling, computational methods for shells and spatial structures, nonlinear material behavior, computational mechanics for masonry structures, mathematical models in mechanobiology, optimization methods for classical and data-driven approaches, and many more.

We are grateful to the GIMC (Gruppo Italiano di Meccanica Computazionale)



Figure 1: Palazzo della Facoltà d'Ingegneria, University of Naples Federico II

and SIMAI (Società Italiana di Matematica Applicata e Industriale) for entrusting the local organizers with the organization of the conference. Their trust and support have been instrumental in ensuring the success of this event.

We would like to express our sincere thanks to the organizing and co-founding institutions, the DIST (Dipartimento di Strutture per l'Ingegneria e l'Architettura) and the Scuola Politecnica e delle Scienze di Base of the Università di Napoli Federico II, for their unwavering support and dedication in making this conference a success, as well as the moral endorsement of the Società Italiana di Scienza delle Costruzioni (SISCO).

We would like to acknowledge the supporting, helpful, and proactive contribution of the Associazione Italiana per gli Studi sulle Strutture Spaziali e a Guscio (4S). Its involvement has been invaluable in advancing the goals of our conference and fostering collaboration within the scientific community.

Finally, and above all we extend our heartfelt gratitude to all the contributors, session organizers, and participants for their valuable contributions and active engagement, which have enriched the conference program and fostered fruitful discussions. We hope that the Book of Abstracts serves as a comprehensive resource, capturing the essence of the cutting-edge research presented at the GIMC SIMAI Young 2024 Conference. May it inspire further exploration and collaboration in the exciting fields of applied mathematics and computational mechanics.

Warm regards,

The organizing committee of the
GIMC SIMAI Young 2024
Salvatore Cuomo, Arsenio Cutolo, Francesco Marmo

Contents

Welcome	v
Plenary lectures	1
Nonlinear manifold learning of chaotic shear flows: the fluidic pinball configuration (<i>Alessandro DELLA PIA</i>)	2
The phase-field modeling of fracture evolution in ductile materials with application to paperboard mechanics (<i>Alessandro MARENGO</i>)	3
Modeling the heart function: mathematical and numerical methods for cardiac electrophysiology-fluid-structure interaction (<i>Michele BUCELLI, Luca DEDE', Alfio QUARTERONI</i>)	5
Numerical modeling of multiphysics flow dynamics with a polytopal method and applications to brain waste clearance (<i>Ivan FUMAGALLI</i>)	6
General contributions	7
A physics-informed deep learning approach for solving strongly degenerate parabolic problems (<i>Pasquale AMBROSIO</i>)	8
Non-linear tensile behavior of yarns and cords (<i>Marco MOSCATELLI</i>) . . .	9
Multiphysics finite element model of resonant surfaces actuated by piezoelectric devices for sound generation (<i>Lucia CICCARELLI, Elisabetta BODO, Valentina BELLO, Sabina MERLO, Simone MORGANTI</i>) . .	10
Preliminary study on the mechanical in-plane response of TPMS structures and their potential application in airless tires (<i>Donato D'APRILE, Ferdinando AURICCHIO, Peter WRIGGERS, Simone MORGANTI</i>)	11
MS 01	
Mathematical Models for Socio-Epidemiological Dynamics	13
(Mis)-information spreading: a geometric analysis of a SIRS epidemic model (<i>Iulia Martina BULAI, Mattia SENSI, Sara SOTTILE</i>)	14
A general kinetic model for the spread of infectious diseases in continuously structured compartments (<i>Tommaso LORENZI, Mattia SENSI, Andrea TOSIN</i>)	15

Increasing situational awareness through nowcasting of the reproduction number (<i>Andrea BIZZOTTO, Giorgio GUZZETTA, Valentina MARZIANO, Martina DEL MANSO, Alberto Mateo URDIALES, Daniele PETRONE, Andrea CANNONE, Chiara SACCO, Piero POLETTI, Mattia MANICA, Agnese ZARDINI, Filippo TRENTINI, Massimo FABIANI, Antonino BELLA, Flavia RICCARDO, Patrizio PEZZOTTI, Marco AJELLI, Stefano MERLER</i>)	16
Estimating the impact of information on real-world epidemics (<i>Rossella DELLA MARCA</i>)	17
Epidemiological models to predict the spread of information on social media (<i>Dajana CONTE, Samira ISCARO, Beatrice PATERNOSTER</i>)	18
A conservative Kinetic framework under the actions of an external force field: Analysis and Application in Epidemiology (<i>Carmelo Filippo MUNAFO', Marco MENALE</i>)	19
Data informed epidemiological-behavioural modelling (<i>Daniele PROVERBIO, Riccardo TESSARIN, Giulia GIORDANO</i>)	20
Learning behavior-disease models via Physics-Informed Neural Networks (<i>Martina RAMA, Gabriele SANTIN, Giulia CENCETTI, Michele TIZZONI, Bruno LEPRI</i>)	21

MS 02

Efficient numerical methods for evolutionary Partial Differential Equations, with applications	23
Implicit-explicit (IMEX) schemes for inhomogeneous flow problems (<i>Douglas RAMALHO QUEIROZ PACHECO</i>)	24
Exploring uncertainty in traffic flow modeling (<i>Elisa IACOMINI</i>)	25
Derivation of new classes of efficient W-methods for stiff PDEs models (<i>Dajana CONTE, Severiano GONZALEZ-PINTO, Domingo HERNANDEZ-ABREU, Giovanni PAGANO, Beatrice PATERNOSTER, Soledad PEREZ-RODRIGUEZ</i>)	26
Numerical challenges of a novel class of hybrid models for collective cell dynamics with non-local interactions (<i>Marta MENCI</i>)	27
A convergent finite volume method for a kinetic model for interacting species (<i>Julia I.M. HAUSER, Valeria IORIO, Markus SCHMIDTCHEN</i>)	29
Numerical solutions for Riemann problem applied to traffic flow (<i>Angela RICCIARDELLO, Marianna RUGGIERI, Giorgia VITANZA</i>)	30
Deep Learning for Model Order Reduction in Partial Differential Equations (<i>Emanuele ZANGRANDO</i>)	31
Efficient Solution of a Phase Field Model for Pitting Corrosion (<i>Dajana CONTE, Gianluca FRASCA-CACCIA, Beatrice PATERNOSTER</i>)	32

MS 03

Multi-scale approaches and machine learning techniques in material modelling	33
Modelling and Simulation of Viscoelastic Cosserat Rods (<i>Sara GALASSO</i>)	35

Multiscale Homogenization for Dual Porosity Time-Dependent Flow (<i>Alberto GIRELLI, Giulia GIANTESIO, Alessandro MUSESTI, Raimondo PENTA</i>)	36
Implementation of Gaussian Process Regression to strain data in residual stress measurements by Hole Drilling (<i>Simone CARONE, Claudia BARILE, Caterina CASAVOLA, Giovanni PAPPALETTERA</i>)	37
A variational procedure for nonholonomic systems stemming from the macroscopic effect of small-scale interactions (<i>Andrea PASTORE, Alessandro GIAMMARINI, Alfio GRILLO</i>)	38
Mechanical properties of Bio-Compounds (<i>Aldo Jesus RUTA</i>)	39
Viscoelastic Magnetorheological Elastomer-Based Laminate for Tuneable Vibration Absorber (<i>Matteo RUGGIERI, Jacopo CIAMBELLA, Stephan RUDYKH, Giuseppe TOMASSETTI</i>)	40
Wavelet Scattering Transform for multi-scale processes. An introduction and applications in Machine Learning (<i>Alessandro LICCIARDI, Davide CARBONE, Lamberto RONDONI</i>)	41
Investigating the Dynamics of Avascular Tumour Growth: A Variable-Order, Non-Local Modelling Approach (<i>Mariam ALMUDARRA, Ariel RAMÍREZ-TORRES</i>)	42
Integrating Neural Networks into the Parallel Rheological Framework for Improved Constitutive Modeling of Elastomers (<i>Federico CALIFANO and Jacopo CIAMBELLA</i>)	43
Asymptotic homogenisation of non-linear viscoelastic composites: Effective coefficients and potential biological applications. (<i>Alejandro ROQUE-PIEDRA, Reinaldo RODRÍGUEZ-RAMOS, Raimondo PENTA, Ariel RAMÍREZ-TORRES</i>)	44

MS 04

Nonlinear material behavior: computational methods and numerical modeling	45
Cover cracking in carbonated reinforced concrete – a coupled multi-physics model (<i>Lorenzo MINGAZZI, Francesco FREDDI</i>)	46
Computational modelling of 3D printed materials based on a nonlocal orthotropic damage-plastic model (<i>Denis LINARDI, Elisabetta MONALDO, Sonia MARFIA</i>)	47
AT1 high-order Isogeometric phase-field modeling for brittle fracture (<i>Luigi GRECO, Eleonora MAGGIORELLI, Matteo NEGRI, Alessia PATTON, Alessandro REALI</i>)	49
A procedure for the experimental identification of the strain Gradient characteristic length (<i>Nasrin REZAEI, Johannes RIESSELMANN, Anil MISRA, Daniel BALZANI, Francesca ROSCINI, Luca PLACIDI</i>)	50
Nonlinear Behavior of Reinforced Concrete for Modeling and Ensuring the Safety of Nuclear Facility Structures Under Seismic Loading (<i>Giulia D'ORIO</i>)	52

An elastoplastic hybrid virtual element formulation (<i>Francesco Salvatore LIGUORI, Antonio MADEO, Giovanni GARCEA, Sonia MARFIA, Elio SACCO</i>)	53
Phase-field ductile fracture simulations of hot cracking in additive manufacturing (<i>Hui RUAN, Xianglong PENG, Yangyiwei YANG, Dietmar GROSS, BaiXiang XU</i>)	54

MS 05

Computational Methods for Shells and Spatial Structures	55
Shells' shape morphing through distortions: a first parametric analysis (<i>Lucia MARIANI, Valerio VARANO, Stefano GABRIELE, Leopoldo Vincenzo GRECO, Massimo CUOMO</i>)	56
Structural behaviour of Crinkle Crankle walls (<i>Matteo LAI</i>)	57
A differential geometry-based design procedure for self-deployable geodesic gridshells (<i>Davide PELLECCCHIA, Francesco MARMO, Luciano ROSATI</i>)	58
On the influence of kinematic boundary conditions on the form-finding of funicular shell structures (<i>Claudia CHIANESE, Francesco MARMO, Luciano ROSATI</i>)	59
Large deformation Kirchhoff-Love shell hierarchically enriched with warping: isogeometric formulation and modeling of alternating stiff/soft layups (<i>Domenico MAGISANO, Antonella CORRADO, Leonardo LEONETTI, Josef KIENDL, Giovanni GARCEA</i>)	60
Efficient closed-form differentiation of the geometrically nonlinear finite element solution for structural optimization (<i>Domenico MAGISANO, Leonardo LEONETTI, Giovanni GARCEA</i>)	61
Design of tensegrity-origami structures based on Snelson's towers (<i>Giulia SERGI, Ilaria GIANNETTI, Andrea MICHELETTI</i>)	62
Generation of eccentricity lines on continuous shells (<i>Arianna VENETTONI, Valerio VARANO, Ginevra SALERNO, Stefano GABRIELE</i>)	63
Experimental and numerical investigation on multistable tensegrity-like chains for lattice metamaterials (<i>Claudio INTRIGILA, Andrea MICHELETTI, Nicola A. NODARGI, Paolo BISEGNA</i>)	64
Improved Multibody Rope Approach and Evolutionary optimization for free-form gridshells (<i>Jonathan MELCHIORRE, Amedeo MANUELLO BERTETTO, Giuseppe Carlo MARANO</i>)	65
Optimizing Gridshell Dome Shapes Based on Seismic Response: The Impact of Dynamic Analysis and Supplementary Damping Devices (<i>Alireza HOSSEINI, Bruno BRISEGHELLA, Gian Felice GIACCU, Luigi FENU</i>)	66

MS 06

Advances in Computational Mechanics and Applied Mathematics for the Assessment, Monitoring, and Design of Masonry Structures	67
Berra brick and concrete floor: preservation issues (<i>Matteo LAI, Davide DI NARO</i>)	69
A Novel Iterative Approach for Kinematic Limit Analysis of Masonry Blocks Using Linear Programming (<i>Mariaceleste LASORELLA, Aguinardo FRADDOSIO, Elio SACCO, Mario Daniele PICCIONI</i>)	70

Finite Element Mohr-Coulomb model for Normal Rigid No-tension Masonry like Material (<i>Amal GERGES</i>)	71
Aluminium alloy system for an integrated seismic – energy retrofit of existing masonry structures (<i>Giovanna LONGOBARDI, Antonio FORMISANO</i>)	72
Time-history analysis of sliding-rolling mechanical systems (<i>Ester SALLI-CANDRO, Roberto SERPIERI, Michela MONACO</i>)	73
Non-linear FE modelling of UR masonry buildings: shear-flexural behaviour of piers and spandrels (<i>Marco POSTIGLIONE, Giuseppe BRANDONISIO, Bruno CALDERONI</i>)	74
Multi-dimensional crack movements at an ageing three-span masonry arch bridge: distributed monitoring and characterisation (<i>Sam COCKING, Matthew DEJONG</i>)	75
MS 07	
Nonlinear phenomena in physics and engineering	77
Material nonlinearities in peridynamic plates: crack nucleation and delamination under unexplored loading conditions (<i>Sofia DAMIAN, Riccardo CAVUOTO, Nicola M. PUGNO, Massimiliano FRALDI, Luca DESERI</i>)	78
Identification of defect modes through Floquet–Bloch boundary conditions (<i>Fabrizio ALOSCHI</i>)	79
Effect of frictional non-linearity on damage detection (<i>Giancarlo SANTAMATO, Massimiliano SOLAZZI, Antonio FRISOLI</i>)	80
Nonlinear modeling and dynamic analysis of anchored and freestanding nonstructural elements (<i>Daniilo D’ANGELA, Gennaro MAGLIULO</i>)	81
Flutter-like instability in piecewise-smooth mechanical systems (<i>Marco ROSSI</i>)	82
Nonlinear formulation of thin films with a nonlocal microstructure (<i>Riccardo CAVUOTO, Arsenio CUTOLO, Luca DESERI, Massimiliano FRALDI</i>)	83
Analytic results on the propagation of solitary waves on tensegrity lattices (<i>Julia DE CASTRO MOTTA, Ada AMENDOLA, Fernando FRATERNALI</i>)	84
Experimental evaluation of optimized Sliding Tuned Liquid Column Dampers for structural vibration control (<i>Chiara MASNATA, Christoph ADAM and Antonina PIRROTTA</i>)	85
Thermal pulse propagation beyond the Maxwell–Cattaneo theory: nonlinear generalizations (<i>Maria DI DOMENICO, David JOU, Antonio SELLITTO, Vittorio ZAMPOLI</i>)	86
MS 08	
Particles in Numerical Simulations: trends and applications	89
A new model for the emergence of vascular networks (<i>Diane PEURICHARD, Pedro ACEVES-SANCHEZ, Benjamin AYMARD, Pol KENNEL, Pierre DEGOND, Anne LORSIGNOL, Louis CASTEILLA, Franck PLOURABOUE’</i>)	90
Breaking consensus in kinetic opinion formation models on graphons (<i>Bertram DÜRING, Jonathan FRANCESCHI, Marie-Therese WOLFRAM, Matia ZANELLA</i>)	91

Particle-In-Cell method to control plasma instabilities via an external magnetic field. (<i>Giacomo ALBI, Giacomo DIMARCO, Federica FERRARESE, Lorenzo PARESCHI</i>)	92
A data-driven kinetic model for opinion dynamics with social network contacts (<i>Giacomo ALBI, Elisa CALZOLA, Giacomo DIMARCO</i>)	93
Consensus-based algorithms for random optimization problems (<i>Sabrina BONANDIN, Michael HERTY</i>)	94
A micro-macro decomposition for consensus dynamics with PSO methods (<i>Michael HERTY, Sara VENERUSO</i>)	95
Kinetic models for global optimization (<i>Frédéric BLONDEEL</i>)	96

MS 09

Non-Newtonian complex fluids: recent advancements in mathematical modeling and applications	97
Falkner-Skan boundary layer flow of a fluid with pressure-dependent viscosity past a stretching wedge with suction or injection (<i>Rebecca TOZZI, Lorenzo FUSI</i>)	98
Effects of Hydrodynamic Coupling on Purcell Microswimmers (<i>Rossella ATTANASI, Marta ZOPPELLO, Gaetano NAPOLI</i>)	99
Thermo-mechanical modeling of pancakelike domes on Venus (<i>Benedetta CALUSI, Angiolo FARINA, Lorenzo FUSI, Fabio ROSSO</i>)	100
Well-posedness and stability of slightly compressible Boussinesq’s flow in Darcy–Bénard problem (<i>Giuseppe ARNONE, Florinda CAPONE</i>)	101
Thermal convection in a rotating Kelvin–Voigt fluid (<i>Francesco IOVANNA, Florinda CAPONE, Roberta DE LUCA</i>)	102
A weakly nonlinear analysis of the Sutton problem (<i>Jacopo GIANFRANI, Florinda CAPONE, Giuliana MASSA, Andrew REES</i>)	103

MS 10

Computational approaches for integral and differential models: real-world applications	105
Parallel-in-time solver for the all-at-once Runge–Kutta discretization (<i>Santolo LEVEQUE, Luca BERGAMASCHI, Ángeles MARTÍNEZ, John W. PEARSON</i>)	106
A Parallel and Conservative Semi-Lagrangian Scheme for Optimal Control in Production-Destruction Processes (<i>Mario PEZZELLA, Alessio OLIVIERO</i>)	107
Dating Domus de Janas: an application of the seriation problem (<i>Elisa CRABU, Giuseppe RODRIGUEZ, Giuseppa TANDA</i>)	108
Approximation of the circular Hilbert transform using Szegő and anti-Szegő quadrature rules (<i>Luisa FERMO, Valerio LOI*</i>)	109
Vector extrapolation methods for the regularization of ill-posed problems (<i>Andrea AZZARELLI, Claude BREZINSKI, Caterina FENU, Michela REDIVO-ZAGLIA, Giuseppe RODRIGUEZ</i>)	110
A line method for reaction-diffusion models in population theory (<i>Domenico MEZZANOTTE, Donatella OCCORSIO, Ezio VENTURINO</i>)	111

Off-the-grid regularisation methods for image deconvolution with Poisson noise (<i>Marta LAZZARETTI, Claudio ESTATICO, Luca CALATRONI</i>)	112
MS 11	
Advanced Analytical and Computational Approaches for Complex Dynamical Systems	113
Nonlinear dynamic analysis of hysteretic mechanical systems by using mode superposition in conjunction with an explicit time integration method (<i>Salvatore VECCHIE', Nicolò VAIANA</i>)	114
Frequency response curve analysis of negative stiffness metamaterials using the Vaiana-Rosati model (<i>Raffaele CAPUANO, Nicolò VAIANA, Luciano ROSATI</i>)	115
Classification and modeling of the complex hysteretic responses of timber connections (<i>Agnese SPEDICATO, Nicolò VAIANA, Luciano ROSATI</i>)	116
The Human-Induced Vibration Analysis of a Continuous Steel – R.C. Composite Footbridge (<i>Habibollah KATOULI, Giorgio SERINO</i>)	117
Comparative analysis of building structures equipped with different types of rate-independent hysteretic dampers (<i>Ciro NAPOLITANO, Nicolò VAIANA, Luciano ROSATI</i>)	118
Experimental and numerical investigation on a real scale structure under forced vibrations (<i>Nadir ALBO, Marcello FULGIONE, Ida MASCOLO, Mariano MODANO, Mariacristina SPIZZUOCO</i>)	119
MS 12	
Mathematical modeling in mechanobiology	121
Elastic-damaging cohesive law for cell-substrate adhesion: positive and negative durotaxis (<i>Gino Antonio REHO, Elena BENVENUTI</i>) . . .	122
A "gradient" approach for the inelastic processes characterizing biphasic aggregates in non-darcian regime (<i>Andrea PASTORE, Alessandro GIAMMARINI, Ariel RAMÍREZ-TORRES, Alfio GRILLO</i>)	123
An optimization based 3D-1D coupling approach for angiogenesis simulations (<i>Stefano BERRONE, Chiara GIVERSO, Denise GRAPPEIN, Luigi PREZIOSI, Stefano SCIALO</i>)	124
Chemo-mechanical description of lipid membrane heterogeneity (<i>Chiara BERNARD, Angelo Rosario CAROTENUTO, Nicola Maria PUGNO, Luca DESERI, Massimiliano FRALDI</i>)	125
Multiscale methods in Biomechanics: modelling two-scale non-elastic phenomena (<i>Salvatore DI STEFANO, Giuseppe FLORIO, Giuseppe PUGLISI, Ariel RAMÍREZ-TORRES</i>)	126
Some insights into the role of cells in tissues' mechanobiology (<i>Stefania PALUMBO</i>)	127
MS 13	
Advanced numerical methods for coupled problems on complex domains	129

Including low-dimensional features in 2D surface models (<i>Elena BACHINI, Antonia LARESE, Mario PUTTI, Guglielmo SCOVAZZI</i>)	130
Efficient parallel finite element simulations of laser beam welding processes (<i>Tommaso BEVILACQUA, Axel KLAWONN, Martin LANSER, Adam WASIAK</i>)	131
Polytopal discontinuous Galerkin methods for proteins' spreading in neurodegeneration (<i>Mattia CORTI, Paola F. ANTONIETTI, Francesca BONIZZONI</i>)	132
A novel quadrature algorithm for mortar method based on radial basis functions (<i>Daniele MORETTO, Andrea FRANCESCHINI, Massimiliano FERRONATO</i>)	133
The Lighting Virtual Element Method (<i>Manuel TREZZI</i>)	134
VEMcomp: an open-source Bulk-Surface Virtual Element library in MATLAB and applications in electrochemistry (<i>Massimo FRITTELLI, Ivonne SGURA, Anotida MADZVAMUSE, Benedetto BOZZINI</i>) . .	135
Particle Finite Element Method Applied to Sediment Transport and Erodeable Surfaces (<i>Simone MARTINI, Massimiliano CREMONESI</i>)	136
A high-order Discontinuous Galerkin method for the numerical modeling of epileptic seizures (<i>Caterina Beatrice LEIMER SAGLIO, Stefano PAGANI, Mattia CORTI, Paola F. ANTONIETTI</i>)	137
A PFEM-VEM Explicit Lagrangian Approach for Free-surface Fluid Modelling (<i>Cheng FU, Massimiliano CREMONESI, Umberto PEREGO, Blaž HUDOBIVNIK, Peter WRIGGERS</i>)	138
Robust discontinuous Galerkin-based approximation of the fully-coupled thermo-poroelastic problem (<i>Stefano BONETTI, Michele BOTTI, Paola F. ANTONIETTI</i>)	139
Polytopal discontinuous Galerkin discretization of a coupled Stokes-poroelasticity problem arising in brain fluid dynamics (<i>Ivan FUMAGALLI, Mattia CORTI, Nicola PAROLINI, Marco VERANI, Paola F. ANTONIETTI</i>)	140

MS 14

Mathematical models in oncology: cancer development and treatment optimisation	141
Modeling the proliferation of multiple extra-chromosomal DNA types in human cancer cells (<i>Elisa SCANU, Benjamin WERNER, Weini HUANG</i>)	142
Modelling the impact of electroporation on spheroid growth and the release of damage-associated molecular pattern molecules (<i>Emma LESCHIERA, Nicolas MATTEI, Clair POIGNARD</i>)	143
Unravelling the connection between hypoxia and intra-tumour heterogeneity through mathematical modelling (<i>Giulia CELORA, Joe PITTFRANCIS, Philip MAINI, Helen BYRNE</i>)	144
Adhesion dynamics of circulating tumor cells: data analysis through mathematical modeling (<i>Giorgia CIAVOLELLA</i>)	145

Optimizing radiotherapy dosing spacings in glioblastoma: Insights from mathematical modeling and in silico trials (<i>Miguel PERALES-PATÓN, Juan JIMÉNEZ-SÁNCHEZ, Juan BELMONTE-BEITIA, Jesús BOSQUE-MARTÍNEZ, Matteo ITALIA, Víctor PÉREZ-GARCÍA, María CASTELLÓ-PONS, Irene GÓMEZ-SORIA, Pilar SÁNCHEZ-GÓMEZ</i>)	146
Multiscale Modelling of Electroporated Tumour Tissue: A Numerical Study (<i>Zita Borbala FULOP, Raimondo PENTA</i>)	147
Multi-scale model of Snail impact on tumor response to hypoxia (<i>Martina CONTE, Giulia CHIARI, Marcello DELITALA</i>)	148
Tolerant vs. Sensitive: exploring cellular fate in cancer therapy through mathematical modeling (<i>Giada FIANDACA, Marielle PERE, Jeremie ROUX, Madalena CHAVES</i>)	149

MS 15

Advances in mechanics of biological systems and bioinspired materials	151
Reconstruction of the local contractility of the cardiac muscle from visible kinematics data (<i>Giulia POZZI, Davide AMBROSI, Simone PEZZUTO</i>)	152
Multiscale Modelling of Fluid Flow in a Lymph Node (<i>Alberto GIRELLI, Giulia GIANTESIO, Alessandro MUSESTI, Raimondo PENTA</i>) . . .	153
Deformation and failure mechanisms in spider silk fibers (<i>Renata OLIVE, Noy COHEN</i>)	154
Modeling brain tumor growth and therapeutic response in patient-specific geometries via poroelasticity (<i>Giulio LUCCI, Francesca BALLATORE, Chiara GIVERSO</i>)	155
A non-linear structural paradigm to describe the mechanical properties of adherent cells (<i>Chiara BERNARD, Angelo Rosario CAROTENUTO, Stefania PALUMBO, Nicola Maria PUGNO, Luca DESERI, Massimiliano FRALDI</i>)	156
The role of elasticity and adhesion in caterpillars' locomotion (<i>Mario ARGENZIANO, Massimiliano FRALDI, Massimiliano ZINGALES</i>) . .	157
Multiscale models based on statistical mechanics and physically-based machine learning for the thermo-hygro-mechanical behavior of spider silks (<i>Vincenzo FAZIO, Nicola Maria PUGNO, Orazio GIUSTOLISI, Giuseppe PUGLISI</i>)	158
Advancements in scaling laws for fiber-reinforced bilayers (<i>Andrea MIRANDOLA, Davide RICCOBELLI, Arsenio CUTOLO, Angelo Rosario CAROTENUTO, Massimiliano FRALDI, Luca DESERI</i>)	159
Asymptotic Homogenization of bone-like tissue subjected to strain gradient remodeling (<i>Alessandro GIAMMARINI, Ariel RAMIREZ-TORRES, Alfio GRILLO</i>)	160

MS 16

Young advances in numerical approximation of differential problems with applications	161
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Adaptive learning rate in stochastic gradient method for deep learning (<i>Ilaria TROMBINI</i>)	162
Efficient simulation of complex Ginzburg–Landau equations using high- order exponential-type methods (<i>Fabio CASSINI, Marco CALIARI</i>) .	163
A Reduced-Split PINN Technique for Time-Varying Parameter Estima- tion in Compartmental Epidemiological Models with Forecasting Cap- abilities (<i>Caterina MILLEVOI, Damiano PASETTO, Massimiliano FERRONATO</i>)	164
Learning operators through kernel methods for epidemic phenomena (<i>Gio- vanni ZIARELLI, Nicola PAROLINI, Marco VERANI</i>)	165
Deep Learning for parameter estimation in reaction-diffusion PDEs for bat- tery modeling (<i>Maria Grazia QUARTA, Ivonne SGURA, Benedetto BOZZINI, Luca MAINETTI</i>)	166
A Nyström method for nonlinear BVP for Laplace’s equation (<i>Luisa FERMO, Anna Lucia LAGUARDIA, Concetta LAURITA, Maria Grazia RUSSO</i>)	167
Tailoring the design of vascular stents through physics-based topology op- timization (<i>Nicola FERRO, Dario CARBONARO, Francesco MEZ- ZADRI, Diego GALLO, Alberto L. AUDENINO, Claudio CHIAS- TRA, Umberto MORBIDUCCI, Simona PEROTTO</i>)	168
Physics Informed Neural Networks for an Inverse Problem in Peridynamics (<i>Fabio Vito DIFONZO, Luciano LOPEZ, Sabrina Francesca PELLE- GRINO</i>)	169
Recent numerical challenges in the study of integral behavioural epidemic models (<i>Bruno BUONOMO, Eleonora MESSINA, Claudia PANICO, Antonia VECCHIO</i>)	170
Model Order Reduction techniques for pattern formation in a chemotaxis model (<i>Angela MONTI</i>)	171
Numerical methods for solving PDEs modeling angiogenesis processes (<i>Pasquale DE LUCA, Ardelio GALLETTI, Livia MARCELLINO</i>)	172
Cross-Diffusion Driven Instability in a Model for Waterborne Diseases with Allee Effect on Bacteria (<i>Zubair AHMAD, Rosanna CAMPAGNA, Valentina DE SIMONE, Isabella TORCICOLLO, Francesco GIAN- NINO</i>)	173

MS 17

Advances in optimization methods with applications to real-world challenges	175
Gradient flow optimization of wave energy parks (<i>Marco GAMBARINI, Gabriele CIARAMELLA, Edie MIGLIO</i>)	176
A self-organizing swarm intelligence model for meta-heuristic optimization (<i>Alessandro NITTI, Marco D. DE TULLIO, Giuseppe CARBONE</i>) .	177
RISING above challenges: A Deep Learning Approach to SparseCT Image Reconstruction for Practical Medical Applications (<i>Davide EVAN- GELISTA, Elena MOROTTI, Elena LOLI PICCOLOMINI</i>)	178

Optimization problems in a real-world scenario: Cultural Heritage Enhancement (<i>Francesco COLACE, Dajana CONTE, Maria Pia D'ARIENZO, Domenico SANTANIELLO, Alfredo TROIANO, Carmine VALENTINO</i>)	179
Numerical solution of weighted horizontal linear complementarity problems (<i>Francesco MEZZADRI</i>)	180
Integrating Light Quality and Crop Density Effects on Vegetative Growth: A Dynamic Model for Lettuce (<i>Susanna MIRABELLA, Simona PEROTTO, Nicola FERRO, Matteo MATTEUCCI</i>)	181
On a general inexact forward-backward scheme (<i>Silvia BONETTINI, Giorgia FRANCHINI, Danilo PEZZI, Marco PRATO</i>)	182
Automatic reparameterization for the structural optimization of cruise ship hulls (<i>Lorenzo FABRIS, Marco TEZZELE, Ciro BUSIELLO, Mauro SICCHIERO, Gianluigi ROZZA</i>)	183
Optimal surface clothing with elastic nets (<i>Dario ANDRINI, Marco MAGRI, Pasquale CIARLETTA</i>)	184
Bilevel learning optimization and applications (<i>Serena CRISCI</i>)	185
On the acceleration of Plug-and-Play algorithms for medical imaging (<i>Andrea SEBASTIANI, Federica PORTA, Simone REBEGOLDI</i>)	186
MS 18	
New trends in approximation	187
Bifurcations of PDEs with random coefficients (<i>Christian KUEHN, Chiara PIAZZOLA, Elisabeth ULLMANN</i>)	188
Least squares Whitney forms (<i>Ludovico BRUNI BRUNO, Giacomo ELEFANTE</i>)	189
Fast Decaying Polynomial Reproduction (FDPR) (<i>Giacomo CAPPELLAZZO, Stefano DE MARCHI</i>)	190
Regularized imaging from Fourier limited data in high-energy solar astronomy (<i>Anna VOLPARA, Emma PERRACCHIONE, Fabiana CAMATTARI, Frank FILBIR, Alessandro LUPOLI, Michele PIANA, Anna Maria MASSONE</i>)	191
On the Reconstruction of Bandlimited Signals from Random Samples Quantized via Noise-Shaping (<i>Rohan JOY, Felix KRAHMER, Alessandro LUPOLI, Radha RAMAKRISHNAN</i>)	192
Interpolation by integral values on balls (<i>Ludovico BRUNI BRUNO, Giacomo ELEFANTE</i>)	193
MS 19	
Optimization methods for classical and data-driven approaches	195
An Optimisation-Based Fully Segregated Reduced Order Model for Fluid-Structure Interaction Problems (<i>Ivan PRUSAK, Davide TORLO, Monica NONINO, Gianluigi ROZZA</i>)	196
Deep Learning Assisted Optimization of Algebraic Multigrid Methods Parameters in Finite Element Solvers (<i>Matteo CALDANA, Paola F. ANTONIETTI, Luca DEDE'</i>)	197

Optimization of the design of implantable medical devices: An application to transcatheter aortic valves and bioresorbable braided stents (<i>Dario CARBONARO</i>)	198
Online low-rank neural network compression (<i>Emanuele ZANGRANDO</i>) .	199
Alternate Training Procedure for Multi-Task Neural Networks (<i>Stefania BELLAVIA, Francesco DELLA SANTA, Alessandra PAPINI</i>)	200
Numerical solution of a first-order Mean Field Game-elliptic system (<i>Simone CACACE, Dante KALISE, Alessio OLIVIERO, Domènec RUIZ-BALET</i>)	201
Optimal control for orbital transfer of LEO satellites with Low-Thrust engines (<i>Giulia VILLANI</i>)	202
Optimal budget management for multi-fidelity approaches relying on deep learning techniques (<i>Piermario VITULLO, Nicola Rares FRANCO, Paolo ZUNINO</i>)	203

MS 20

Challenges and recent advancements in polytopal methods for PDEs 205

The lightning Virtual Element Method for eigenvalue problems (<i>Manuel TREZZI, Umberto ZERBINATI</i>)	206
Automated Discovery of Artificial Viscosity Models in High-Order Discontinuous Galerkin Methods for Conservation Laws (<i>Matteo CALDANA, Paola F. ANTONIETTI, Luca DEDE'</i>)	207
Improving high-order VEM stability on badly-shaped elements (<i>Stefano BERRONE, Gioana TEORA, Fabio VICINI</i>)	208
Virtual Element approximation for poroelasticity problems (<i>Michele BOTTI, Daniele PRADA, Michele VISINONI</i>)	209
Structure preserving numerical methods for solving PDEs on polytopal grids (<i>Stefano BERRONE, Andrea BORIO, Carlo LOVADINA, Francesca MARCON, David MORA, Michele VISINONI</i>)	210
R3MG: R-tree based agglomeration of polytopal grids with applications to multilevel methods (<i>Marco FEDER, Andrea CANGIANI, Luca HELTAI</i>)	211
Enhanced VEM for plane strain elastoplastic problems (<i>Ossama FIRARI</i>)	212
Advancements in Adaptive Virtual Element Methods (<i>Stefano BERRONE, Claudio CANUTO, Davide FASSINO, Fabio VICINI</i>)	213

MS 21

Recent High-Order Numerical Methods for Partial Differential Equations and Their Applications 215

From supersonic to low Mach flows using multi-point numerical methods (<i>Alessia DEL GROSSO, Raphaël LOUBERE, Pierre-Henri MAIRE</i>)	216
High-order well-balanced schemes for hyperbolic balance laws: preserving stationary solutions which involve resonance (<i>Irene GÓMEZ-BUENO, Manuel Jesús CASTRO DÍAZ, Carlos PARÉS MADROÑAL</i>)	217

High-order fully well-balanced numerical methods for one-dimensional blood flow with discontinuous properties and friction. Application to networks. (<i>Ernesto PIMENTEL-GARCÍA, Manuel Carlos PARÉS, Lucas MÜLLER</i>)	218
Fully exactly well-balanced schemes for the shallow water system (<i>Celia CABALLERO-CÁRDENAS, Manuel Jesús CASTRO, Christophe CHALONS, Tomás MORALES DE LUNA, M^a Luz MUÑOZ-RUIZ</i>)	219
Efficient Numerical Strategies for Hyperbolic Systems and Sediment Evolution in Shallow Water Models (<i>Manuel J. CASTRO, Enrique D. FERNÁNDEZ-NIETO, José GARRES-DÍAZ, Emanuele MACCA, Giovanni RUSSO</i>)	220
Quinpi: Implicit High-Order Schemes for Hyperbolic Systems (<i>Gabriella PUPPO, Matteo SEMPLICE, Giuseppe VISCONTI</i>)	221

Author Index	223
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Elastic-damaging cohesive law for cell-substrate adhesion: positive and negative durotaxis

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The present contribution focuses on the mechanobiological aspects related to cell-substrate adhesion and their involvement in positive durotaxis as well as in the recently discovered negative durotaxis [1]. A key component of this kind of migration is the adhesion between the cell and the extracellular matrix performed through mechanosensitive cell structures called focal adhesion complexes. These structures grow and disrupt during their life cycle undergoing a chemo-physical degradation process which is here modeled by means of an elastic-damaging cohesive law. The resulting traction-sliding law is first applied to a simplified two-element tensegrity model and then exploited in a fully three-dimensional continuum model of a single cell [2-5]. The application of a contractile pre-stretch to the cell shows the inference of the elastic-damaging law. The reversal of positive into negative durotaxis is modelled as a consequence of a force-driven degradation process of the adhesion structures. An optimal stiffness range of the substrate at which the cell deploys its maximum traction force is also detected.

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