ECCOMAS
Thematic Conference

Program

ICBT 2023

5th International Conference on Biomedical Technology

**6th – 8th November 2023
Hannover, Germany**

M H H **Hannover Medical School**

Leibniz
Universität
Hannover

Content

Preface

The V International Conference on Biomedical Technology will be held in Hannover from 6th to 8th of November 2023. The meeting is organized under the auspices of EC-COMAS, and of the Clusters of Excellence PhoenixD, Rebirth**,** Hearing4All and the Collaborative Research Center 298 "SIIRI", and the research center for medical implants NIFE.

Technology meets Medicine
Recent advancements in technology speed up the development of novel tools for supporting diagnostic assessments and the optimization of medical devices for improving clinical approaches. Nevertheless, tailoring of technological developments in Engineering with clinical approaches in Medicine necessitates a thorough understanding of all processes involved and an intensive exchange of information between specialists from different disciplines.

This conference brings together scientists from areas of medicine, engineering, computer and natural sciences. It will focus on the study of living and biological systems, the development and fabrication of new implants, and complications of patient-specifi c medicine.

Hannover, November 2023

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Prof. Prof. h.c. Dr. med.
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Prof. Debie Vickers, University of Cambridge, United Kingdom

Prof. Jan Wouters, Leuven Centre, Belgium

Prof. Tarek Zhodi, University of California, Berkeley, USA

Overview

Start	End	Day 1 Monday 6. November		Day 2 Tuesday 7.November		Day 3 Wednesday 8. November	
08:00		Registration					
09:00	09:15	Opening					MS 04
09:20	10:00	**Plenary Lecture**		**09:00-09:40** **Plenary Lecture**		MS 09	
10:00	11:00	MS 05		MS 01	MS 02	MS 10	
11:00	11:20	Coffee break		Coffee break		Coffee break	
11:20	12:00	MS 05	MS 11	MS 01	MS 06		MS 04
11:20	13:40		MS 11				
13:40	14:20	Lunch		Lunch		Closing	
14:20	16:40	MS 03	MS 12	MS 13			
16:40	17:00	Coffee break		16:45-18:00 Tour German Hearing Center			
17:00	19:00	MS 03	MS 08				
20:00				Congress Dinner			

Plenary Lectures

Professor Elias Cueto
Towards the construction of digital human twins
University Zaragoza, Spain

Professor Michele Marino
In silico models for medical innovation: examples from the cardiovascular system
University of Rome Tor Vergata, UNIROMA2, Italia

Mini Symposia

MS 01: Enabling technologies for tissue engineering: materials, experiments, and simulations

MS 02: Dentistry: Progress in automated diagnostics and computer based patient specific decision support

MS 03: Physics and Data-Driven Methods for Biomechanics and Biomedical applications

MS 04: Additive manufactured dental implants with custom-made functionality based on innovative in vivo, in vitro and in silico methods

MS 05: Exploring Liver Dynamics: Computational Modeling and Simulation across Hierarchical Scales

MS 06: Modeling and characterisation of functional implants for the musculoskeletal system

MS 08: AI in medicine: Big Data, National Cohort and biobank and their role in personalized medicine and rehabilitation

MS 09: Prediction models for disease progression and treatment alternatives – clinical decision support systems

MS 10: Influence of digitalization on early disease detection, diagnosis and diagnostic process, therapy decision and therapy as well

MS 11: Computational Models of the Electrically Stimulated Nervous System

MS 12: Cochlear Implant Impedance Characterization

MS 13: SIRII Symposia: Safety-Integrated Implants

MS 01: Enabling technologies for tissue engineering: materials, experiments, and simulations

organized by Silvia Budday[1], Michele Conti[2] and Michele Marino[3]

[1] Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany
[2] University of Pavia, Italy
[3] University of Rome Tor Vergata, Italy

Tissue engineering promises to create functional tissue equivalents for regenerative medicine and has made remarkable progress in recent decades. Nevertheless, the commercial and clinical implementation of tissue engineering falls short of its full potential. Key challenges include low reproducibility, unclear quality criteria at early time-points, and a lack of quality control methods. These challenges are particularly significant for tissue engineering approaches that involve 3D cell cultures.

This mini symposium aims to ease an interdisciplinary debate in tissue engineering ranging from biology, through chemistry, to mechanics. The topics of interests cover the analysis and understanding of unresolved issues emerging with traditional approaches, up to the role of innovative methodologies in facilitating progresses and scalability of the field. The latter comprise for instance the role of innovative (bio) materials and manufacturing technologies, of cutting-edge experimental techniques for the analysis of tissue engineering constructs, and of in silico tools for design and optimization of both biomaterials and biomanufacturing strategies.

Relevant topics include but are not limited to:

1. characterization and description of biomaterials responses
2. smart and active materials
3. multiscale and multi-field experimental and computational analyses
4. novel biomanufacturing technologies
5. definition and optimization of experimental protocols
6. non-invasive experimental techniques (e.g., optical and electrical methods)
7. process design tools in biomanufacturing and tissue engineering
8. predictive models of cell mechanobiology in tissue engineering constructs
9. mechanistic models and data-driven approaches of cell response
10. experiments and models on cell-biomaterial interactions and neo-tissue formation

MS 02: Dentistry: Progress in automated diagnostics and computer based patient specific decision support
organized by Meike Stiesch, Andreas Greuling

Keywords:
In silico studies, Biomechanical modelling, Image analysis, Computational methods, Dentistry

Many patients suffer from tooth decay or even tooth loss, which requires dental treatment. While small tooth cavities can be relatively easy diagnosed and can often be treated with fillings, there are problems where a (partly) automated detection and diagnosis, insights from in silico models or recommendations gained by machine learning could support patient specific decisions and treatment.

This mini-symposium aims to bring together scientists from various communities in order to discuss the status quo and the future of computer assisted dentistry.

The topics to be discussed in the mini-symposium include:

1. Biomechanical modelling approaches
2. Image recognition approaches
3. Artificial intelligence, machine learning
4. Innovative treatment planning using patient specific data and simulation results
5. Robot assisted treatment

MS 03: Physics and Data-Driven Methods for Biomechanics and Biomedical applications

organized by Ajay B. Harish[1], Marko K Matikainen[2], Fadi Aldhakheel[3], Alexander Popp[4]

[1]Department of Mechanical, Aerospace and Civil Engineering, University of Manchester (UK)
[2]Lappeenranta University of Technology (Finland)
[3]Institute of Mechanics and Computational Mechanics, Leibniz University Hannover (Germany)
[4]University of the Bundeswehr Munich (Germany)

This mini-symposium aims to explore how physics-based models, experimental techniques, and advanced data-driven approaches can enhance our understanding of biological systems, improve diagnosis and treatment, and contribute to the development of innovative technologies. Today, continuum mechanical theories and numerical methods like finite element method (FEM), computational fluid dynamics (CFD) and machine learning (ML) have shown great potential in providing insights into problems ranging from tendonitis, cardiovascular engineering to brain modelling and even wound healing. Yet, most of our work today is clinical driven for good reason but often done in silos. However, the ability to pump-prime projects from the engineering end will help technology development and showcase readiness to clinical counterparts. The availability of multiple solutions can enhance and speedup the developments of proof of concepts and field deployments.

This symposium aims to bring together experts, researchers, and practitioners from various disciplines to share their knowledge, insights, and foster interdisciplinary collaborations.

Of particular interest include:

1. Biomedical problems related to tendons in relation to walking, running and mobility
2. Circulatory system and cardiovascular engineering
3. Continuum mechanics in respiratory systems
4. Patient-specific constitutive modelling
5. Biomedical signal processing and analysis
6. Multiscale modeling and simulation in biomechanics
7. Machine learning in processing for medical imaging to simulation
8. Image-based simulation methods and code-coupling
9. Uncertainty quantification, inverse methods and parameter identification
10. Open-source dataset generation and curation

MS 04: Additive manufactured dental implants with custom-made functionality based on innovative in vivo, in vitro and in silico methods

organized by Andreas Greuling, Meike Stiesch

Keywords: Additive manufacturing, Surface coating, Biofilms, Implants, Dentistry

In modern medicine, dental implants as well as orthopedic implants have been used with success for many years. Many patients suffer from tooth decay or even tooth loss, which requires dental treatment, whereas dental implants are often used as a part of the solution. Despite the stunning success of implants, implant failures are still a relevant problem in modern dentistry. Besides bone loss due to peri-implantitis, unfavorable biomechanical loads and insufficient adaptation of the implant surface to the requirements of the biological tissue are important factors for implant failure. This mini-symposium aims to bring together scientists from the research group FOR 5250 and other experts in the field. It aims at discussing the progress in additive manufacturing, surface coatings, and innovative characterization methods for patient-specific implants, with a main focus on dental implants.

The topics to be discussed in the mini-symposium include:

1. Additive manufacturing of lattice structures
2. Material testing and characterization of additively manufactured lattice structures
3. Coatings of implant surfaces
4. Finite element analysis at micro and macro scale
5. Biological investigations in the context of additive manufactured and titanium based structures

MS 05: Exploring Liver Dynamics: Computational Modeling and Simulation across Hierarchical Scales

organized by Dominik Schillinger, Tim Ricken

The liver is a highly vascularized organ that serves a variety of physiological functions, including metabolism of nutrients and drugs, detoxification, bile production, or hormone regulation. It is characterized by a high degree of vascularization across hierarchical scales, and blood perfusion, tissue response and liver functions are closely linked from the organ scale down to the cellular level. Today, there is a growing number of computational modeling and simulation technology available that can help describe or predict different aspects of liver behavior, functionality and disease.

The aim of this mini-symposium is to showcase current research trends in this direction, including but not limited to:

1. Modeling of liver response, function or disease at different scales
2. Scale-bridging modeling and simulation methods
3. Reconstruction or representation of 3D liver architecture at different scales
4. Experimental methods to quantify liver anatomy and function and their use to validate liver models.

MS 06: Modeling and characterisation of functional implants for the musculoskeletal system

organized by Rainer Bader[1], Manuela Sander[2], Hermann Seitz[3]

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Keywords: functional implants, computational modelling, experimental and material characterization

Functional implants are widely used in the musculoskeletal system. Among other things, they are used as load-bearing implants, e.g. for the treatment of large bone defects or as joint replacements, and as scaffolds to repair cartilage defects. Simulation-based approaches as well as robust experimental investigation methods are helpful for the research, development and preclinical evaluation of the suitability of modern functional implant systems.

This mini-symposium tends to bring together scientists from the Rostock Center for Interdisciplinary Implant Research (ROCINI) and other experts in the field. It aims to discuss innovative modeling approaches and experimental characterization methods of functional implants for the musculoskeletal system.

The topics to be discussed in the mini-symposium include:

1. computational modeling approaches
2. advanced experimental test methods
3. material characterization.

MS 08: AI in medicine - Big Data, National Cohort and biobank and their role in personalized medicine and rehabilitation

organized by Waldo Nogueira

Advances in artificial intelligence and Big Data are transforming many fields including the field of hearing and cochlear implants. There is a need to create computational tools to optimize the cochlear implant healthcare system. Moreover, there is a need to characterize each cochlear implant user in detail o provide personalized treatments.

This minisymposium will present novel technologies in the area of outcome prediction with cochlear implants. These measures includes performance data from each user, precise data from the cochlear implant electrode nerve interface, imaging data from the cochlea and the cochlear implant electrode locations and corresponding anatomical models as well as evoked potentials to characterize the auditory pathway. This minisymposium will present several contributions dealing with tools and technologies to collect and process big and precise data to understand generic trends in cochlear implant healthcare and provide individualized treatments for cochlear implant users.

MS 11: Computational Models of the Electrically, Acoustically and Ontogenetically Stimulated Nervous System

organized by Waldo Nogueira

Electrical stimulation of the nervous system has been shown to be effective to treat different diseases, including the hearing loss, blindness, pain and depression. To achieve optimal stimulation effects and a better understanding of the underlying brain mechanisms, neuro-engineers have proposed computational modelling studies. These models typically combine a geometry and a numerical simulation of the physics occurring through stimulation with a given modality writing the geometry representing the targeting organ. As the need for better computational models continues to increase, we overview here recent modelling studies; we focused on approaches trying to restore the auditory system but we also cover stimulation of other parts of the nervous system. The minisymposium will present recent advances in:

- Computational models of the electrically and acousticcally stimulated auditory system
- Computational models of the ontogenetically stimulated auditory system
- Surrogate models
- Neuron models sensitive to electric, acoustic and optogenetic stimulation
- Computational models of transcranial electric stimulation, retinal impants and other nerves

MS 12: Cochlear Implant Impedance Characterization
organized by Waldo Nogueira

The electrode-neuron interface formed between the cochlear implant electrodes and the auditory nerve plays an important in the outcome with these devices. The telemetry implemented in cochlear implants has enabled researchers to study factors affecting the quality and integrity of the interface. More concrete this minisymposium deals with the characterization of impedances in cochlear implants. This minisymposium will provide current strategies to characterize cochlear implant electrode impedances in vitro and in vivo as well as through computational models. Moreover latest technologies from the industry on how to use impedances to optimize the implantation procedure and to record 24/7 will presented.

MS 13: SIIRI Symposium: Safety-Integrated Implants

organized by Meike Stiesch, Hans Jürgen Maier

While implants are essential in healthcare to restore life-sustaining functions, ensuring their safety and reliability remains a major challenge in various medical disciplines. The comparable high prevalence of implant failures can be due to material corrosion, wear formation and implant loosening as well as bacterial biofilm formation and subsequent inflammatory reaction. The Collaborative Research Center 298 "SIIRI" advances solutions for this topic by the development of computer models to predict implant complications, new methods to study implant-associated infections, detection methods for implant loosening and gentle procedures for implant removal.

This mini-symposium aims to foster collaboration, knowledge sharing, and innovative research efforts to improve safety and efficacy of medical implants.
The topics for this mini-symposium include:

- Computational modeling
- Finite element methods
- Inductive heating for tissue-conserving implant removal
- Acoustic emissions for the detection of implant loosening
- New methods for the investigation of implant-associated infections

Scientific Program

Monday, 6th November 2023

08:00	Registration	Venue: Courtyard Hotel

09:00-09:15	Opening	Venue: Salon 5

09:20-10:00	Plenary Lecture **Towards the construction of digital human twins** *Elias Cueto*	Venue: Salon 5

MS 05:	**Exploring Liver Dynamics: Computational Modeling and Simulation across Hierarchical Scales** organized by Dominik Schillinger, Tim Ricken	Venue: Salon 5

10:00-10:20	**Keynote** **Generation of multiscale hepatic vasculature using rigorous mathe-optimization** *Etienne Jessen, Marc C. Steinbach, Charlotte Debbaut, Dominik Schillinger*
10:20-10:40	Reduced order modeling of blood perfusion in high-dimensionally parametrized liver lobules *Ahsan Ali Siddiqui, Etienne Jessen, Stein K.F. Stoter, Dominik Schillinger*
10:40-11:00	Coupling of a perfusion model to a poroelastic-growth model for modeling liver tissue regrowth *Adnan Ebrahem, Etienne Jessen, Jannes Hohl, Dominik Schillinger*
11:00-11:20	Coffee break
11:20-11:40	A multi-compartment perfusion model of blood flow through deformed hierarchical vessel networks *Jannes Hohl, Adnan Ebrahem, Etienne Jessen, Dominik Schillinger*
11:40-12:00	Mathematical Optimization Models for Synthesizing Hepatic Vascular Trees *Anastasija Kartamysheva, Marc C. Steinbach, Etienne Jessen, Dominik Schillinger*

MS 11	**Computational Models of the Electrically Stimulated Nervous System** organized by Waldo Nogueira	Venue: Salon 6

11:20-11:40	**Keynote** **Computational Models of the Electrically Stimulated Auditory Periphery** *Tania Hanekom*

11:40-12:00 Computational Modelling of Cochlear Implants: Towards Better Speech Coding
Randy Kalkman, Jeroen Briaire, Savine Martens, Jacob de Nobel, Thomas Bäck, Johan Frijns

12:00-12:20 Can computer models explain the variability in cochlear implant outcomes?
Siwei Bai, Albert Croner, Carmen Marie Castañeda González, Ali Saeedi, Rudolf Glückert, Anneliese Schrott-Fischer, Werner Hemmert

12:20-12:40 A Full Head Model to Analyze Intra and Extra-cochlear Electric Fields under Different Cochlear Implant Stimulation Strategies
M.A. Callejón-Leblic, A. Fratter, F. Ropero-Romero, J. Reina, S. Sánchez-Gómez

12:40-13:00 A Non-spiking Model of the Electrically Stimulated Auditory Nerve
Rebecca C. Felsheim, Mathias Dietz

13:00-13:20 Non-intrusive reduced order modeling of patient-specific cochlear implants
Fynn Bensel, Marlis Reiber, Yixuan Zhang, Daniel Kipping, Udo Nackenhorst, Waldo Nogueira

13:20-13:40 In silico sound encoding evaluation framework supporting future optogenetic cochlear implants development
Lakshay Khurana, Lukasz Jablonski, Tobias Moser

13:40-14:20 Lunch break

14:20-14:40 Anatomical Detailed Volume Conductor Model of the Neck for Phrenic Nerve Stimulation
Laureen Wegert, Alexander Hunold, Marek Ziolkowski, Irene Lange, Tim Kalla, Jens Haueisen

14:40-15:00 Transcranial stimulation computational models
Alexander Hunold

15:00-15:20 A Computational Model of the Electrically or Acoustically Evoked Compound Action Potential in Cochlear Implant Users with Residual Hearing
Daniel Kipping, Yixuan Zhang, Waldo Nogueira

MS 12: **Cochlear Implant Impedance Characterization**
organized by Waldo Nogueira   Venue: Salon 6

15:20-15:40 Electrode-electrolyte interface modelling in cochlear implants
Behnam Molaee-Ardekani, Mary J. Donahue, Manuel Segovia-Martinez

15:40-16:00 Loudness recruitment in computational models of electrically stimulated cochlea
Franklin Alvarez, Yixuan Zhang, Daniel Kipping, Waldo Nogueira

16:00-16:20 Analysis of cochlear implant impedances across time
Sarah Vormelcher, MEDEL

16:20-16:40 Placement check of cochlear implant electrode array using objective measurements
Tom Bertens, Cochlear

16:40-17:00 Coffee break

MS 03: Physics and Data-Driven Methods for Biomechanics and Biomedical applications

organized by Fadi Aldhakheel, Marko K Matikainen, Fadi Aldhakheel, Alexander Popp, Ajay B. Harish   Venue: Salon 5

14:20-14:40 Exploring Vascular Wall Fracture through an Integrated Experimental and Numerical Approach
Marta Alloisio, Fadi Aldakheel, T. Christian Gasser

14:40-15:00 Efficient Deep Learning for Analyzing Porcine Aorta Fractures
Alexandros Tragoudas, Marta Alloisio, Elsayed Saber Elsayed, T. Christian Gasser, Fadi Aldakheel

15:00-15:20 Complex aortic arch repair: a FSI analysis
Sampad Sengupta, Xiao Yun Xu

15:20-15:40 Efficient patient specific modelling for the monitoring of implants
Fynn Bensel, Marlis Reiber, Udo Nackenhorst

15:40-16:00 Porous media models for medical devices in cerebral aneurysms after endovasuclar intervention
Martin Frank

16:00-16:20 Laplacian Eigenmaps for Anatomical Landmarks Detection and Knee Kinematics Axis Indentification
Matteo Bastico, Etienne Decencière, Laurent Corté, Yannick Tillier, David Ryckelynck

16:20-16:40 Probabilistic fluid-structure interaction framework for cardiovascular engineering
Aryan Tyagi, Ajay B. Harish

16:40-17:00 Coffee break

17:00-17:20 Fluid dynamics of right ventricular filling for patients with repaired tetralogy of fallot: assessment using DNS and 4D Flow MRI
I. Yildiran, F. Capuano, Y.H. Loke, L.J. Olivieri , E. Balaras

17:20-17:40 Simulation of a Thermoelectric Generator Implanted in Human Body Model
Yongchen Rao, Tamara Bechtold, Dennis Hohlfeld

18:00-18:20   Particle-wall interaction computational model for nasal drug delivery
Silvia Ceccacci, Hadrien Calmet, Clement Rigaut, Benoit Hout, Guillaume Houzeaux, Beatriz Egutzkitza

18:20-18:40   OSS-DBS v2.0: An advanced volume conductor model for optimization in deep brain stimulation
Jan Philipp Payonk

18:40-19:00   Coupling finite elements and multibody dynamics for deformation analysis of the Achilles tendon
Leonid Obrezkov, Alexander Nemov, Ajay Harish, Taija Finni, Marko K. Matikainen

19:00-19:20   pyProcessingPipeline: a database-backed open-source processing package to support the development of diagnostic models and patient specific decision algorithms
Christian Teichert, Urs Hackstein, Stefan Bernhard

19:20-19:40   Heart modelling for the output performance prediction of triboelectric nanogenerators using finite element methods
Teresa Cheng, Navid Valizadeh, Ling Yang, Xiaoning Jiang, Xiaoying Zhuang

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MS 08   **AI in medicine – Big Data, National Cohort and biobank and their role in personalized medicine and rehabilitation**
organized by Waldo Nogueira   Venue: Salon 6

17:00-17:20   A multimodal database and artificial-intelligence pipeline to analyze and predict cognitive impairment in age-related hearing loss
S. Blanco-Trejo, M. A. Callejón-Leblic, B. Villarreal-Garza, A. M. Picazo-Reina, B. Tena-García, A. Lara-Delgado, M. Álvarez-Cendrero, F. López-Benitez, F. Escobar-Reyero, A. Moreno-Conde, J. Moreno-Conde, Y. Cabrales-Fontela, L. Padilla-Blanco, D. Martínez-Campos, Eduardo Ferrera, M. M. Barrios-Romero, M. Bastarrica-Martí, M. Atienza-Ruiz, J. L. Cantero-Lorente, C. López-Ladrón, C. Alonso-González, F. Ropero-Romero, S. Sánchez-Gómez

17:20-17:40   Development of a Machine Learning System for Predicting Cochlear Implant Performance: Analysis of a Large Retrospective Dataset
Alexey Demyanchuk, Eugen Kludt, Thomas Lenarz, Andreas Büchner

17:40-18:00   From a Single Site Relational Database to Multi-Site Interoperability: Enhancing Cochlear Implant Data Integration with openEHR
Eugen Kludt, Andreas Büchner

18:00-18:20   Big Data and Hearing Aids - some results from a large customer data base
Martin Kinkel, KIND

18:20-18:40   Nautilus: Toward fast personalized tonotopic maps using shallow neural networks for cochlear image analysis in web browsers

Behnam Molaee-Ardekani, Oticon Medical

18:40-19:00   Individualizing cochlear implant surgery with innovations in radiological imaging

Stephan Geiger, Tim Nauwelaers, Ersin Avci, Pierre Guillon, Advanced Bionics

Tuesday, 7th November 2023

08:00 Registration Venue: Courtyard Hotel

09:00-09:40 Plenary Lecture
In silico models for medical innovation: examples from the cardio-vascular system
Michele Marino Venue: Salon 5

MS 01: Enabling technologies for tissue engineering: materials, experiments, and simulations
organized by Silvia Budday, Michele Conti, Michele Marino Venue: Salon 5

09:40-10:00 On the size of vascular tissue specimens for in-vitro tissue characterization
Marta Alloisio, Joey Wolff, T. Christian Gasser

10:00-10:20 The impact of residual strains on the stress analysis of atherosclerotic carotid vessels: predictions based on the homogenous stress hypothesis
Alessandro Mastrofini, Michele Marino, Eva Karlöf, Ulf Hedin, T. Christian Gasser

10:20-10:40 A Multi-Physical Computational Model for Simulating Pathological Ventricular Remodelling in Human Myocardial Growth
Yongjae Lee, Baris Canisz, Michael Kaliske

10:40-11:00 Improving Insight Into 3D Cell Cultures Through Image Analysis of Fluorescent Reporter Cells
Nico Ulber

11:00-11:20 Coffee break

11:20-11:40 Polymer mechanical and multiphysics modelling in 3D tissue bio-printing
Lorenzo Zoboli, Michele Marino, Alessio Gizzi

11:40-12:00 GO:ELP co-assembling system as a coating for PCL vessel scaffolds: a computational study to fine-tune the thickness membrane formation
Giulia M. Di Gravina, Jordan Hill, Ferdinando Auricchio, Tomasz Jungst, Alvaro Mata, Michele Conti

12:00-12:20 Lipid membranes remodeling arises from chemo-mechanical interplay
Chiara Bernard, Angelo Rosario Carotenuto, Massimiliano Fraldi, Luca Deseri

12:20-12:40 Computational modeling of cell motility within biodegradable hydro-gel scaffolds for tissue engineering applications: a phase-field approach
Pierfrancesco Gaziano, Michele Marino

12:40-13:00 Modeling the maturation process of tissue-engineered biohybrid heart valve implants
Mahmoud Sesa, Hagen Holthusen, Lukas Lamm, Christian Böhm, Tim Brepols, Stefan Jockenhövel, Stefanie Reese

13:20-14:20 Lunch break

MS 02 **Dentistry Progress in automated diagnostics and Computer based patient specific decision support**
organized by Andreas Greuling, Meike Stiesch   Venue: Salon 6

09:40-10:00 Automated remodeling of connectors in Fixed Partial Dentures: Finite Element Analysis
Hassen Jemaa, Michael Eisenburger, Andreas Greuling

10:00-10:20 Automatic adaption of occlusal crown surfaces via Laplacian mesh editing
Oliver Roffmann, Meike Stiesch, Andreas Greuling

10:20-10:40 Towards a Methodology for Fatigue Analysis of Dental Implants considering Bone Remodelling
Bruno Luna, Meike Stiesch, Andreas Greuling

10:40-11:00 Using Cone-Beam Computed and Micro-Computed Tomography for the automated measurement of the three-dimensional Root Canal Curvature and Working Width
Marie-Theres Kühne, Michael Kucher, Niels Modler, Christian Hannig, Martin Dannemann

11:00-11:20 Coffee break

MS 06 **Modeling and characterisation of functional implants for the musculoskeletal system**
organized by Rainer Bader, Manuela Sander, Hermann Seitz   Venue: Salon 6

11:20-11:40 Determination of hip joint forces and physical activity using an energy autonomous total hip replacement stem
Franziska Geiger, Henning Bathel, Sascha Spors, Rainer Bader, Daniel Kluess

11:40-12:00 Characterization and modelling of the mechanical behaviour of articular cartilage tissue and substitute biomaterials
Nada Abroug

12:00-12:20 Musculoskeletal multibody simulation provides personalized boundary conditions for finite element modeling of the human masticatory system
Ann-Kristin Becker

12:20-12:40   Experimental and numerical investigations on the mechanical reliabili ty of an additively manufactured implant for large mandibular defects
Wiebke Radolf, Tilmann Allzeit , Chrisopher Benz, Laura Lembcke, Nadja Engel, Peer Kämmerer, Manuela Sander

12:40-13:00   Influence of the corrosion morphology on remaining strength of bio-degradable Mg alloys at an early time point
Petra Maier, Benjamin Clausius, Nils Wegner, Frank Walther

13:00-13:20   Enhancing Cellular Modelling with Realistic Boundary Conditions: Leveraging Digital Twin Applications for Image-Based Analysis
Lam Vien Che, Meike Bielfeldt, Nils Arbeiter, Ursula van Rienen , Julius Zimmermann

13:20-14:20   Lunch break

MS 13   SIIRI – Safety-Integrated Implants

organized by Marly Dalton, Meike Stiesch   Venue: Salon 5

14:20-14:40   Modelling Scar Tissue in Cochlear Implants
Tania Hanekom

14:40-15:00   A Computational Modeling Framework for Auditory Nerve Stimulation with a Cochlear Implant and the Novel Auditory Nerve Implant
Waldo Nogueira

15:00-15:20   A biological growth model based on the extension of the Hamilton principle
Felix Klempt, Meisam Soleimani, Philipp Junker

15:20-15:40   Laser-based culturomics, single cell force spectroscopy and sequen-cing for studying implant-associated biofilms
Szymon Szafranski

15:40-16:00   A neuronal network-based approach to discriminate between bacteria and cells on co-cultured implant materials
Katharina Nikutta

16:00-16:20   Discriminating human and animal bone acoustic signatures: Implica-tions for in-vitro acoustic analysis and in-vivo applications
Eike Jakubowitz

16:20-16:40   Tissue-conserving removal of cemented hip arthroplasties by trans-cutaneous inductive heating
Florian Nürnberger

16:45-18:00   Tour through German Hearing Center (DHZ), Hannover Medical School
All participants obtain a tram-ticket to go via tram line 4 from „Aegidientorplatz" to „Medizinische Hochschule Hannover"

20:00-22:00   Congress Dinner
Restaurant Bell Arte - see page 30
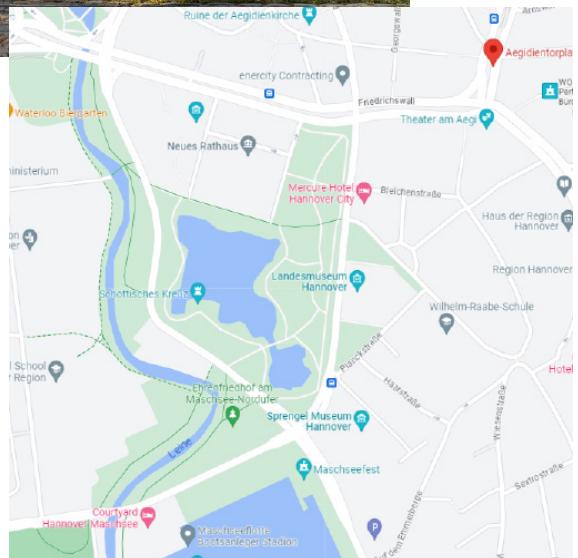
Wednesday, 8th November 2023

| 08:00 | Registration | Venue: Courtyard Hotel |

MS 09: **Prediction models for disease progression and treatment alternatives - clinical decision support systems**
organized by Andreas Büchner   Venue: Salon 5

09:20-09:40   The role of vasa vasorum in atherosclerosis - biomechanical analysis of the outside-in disease hypothesis
Meisam Soleimani, T.Christian Gasser, Philipp Junker, Axel Haverich, Peter Wriggers

MS 10: **Influence of digitalization on early disease detection, diagnosis and diagnostic process, therapy decision and therapy as well**
organized by Thomas Lenarz   Venue: Salon 5

09:40-10:00   Influence of hemodynamics on the initiation of middle cerebral artery bifurcating aneurysms
Chanikya Valeti, Omkar Sanjay Karve, Niroop B. S., Darshan H. R. B. S. V. Patnaik, B. J. Sudhir

10:00-10:20   Computational Fluid Dynamics based simulation of an ICA Aneurysm high-flow bypass: pre and post surgery
Pratik M Panchal, Sam S., Gowtham M, Manjunath M, Asif S, B.S.V Patnaik, B.J Sudhir

MS 04 **Additive manufactured dental implants with custom-made functionality based on innovative in vivo, in vitro and in silico methods**
organized by Andreas Greuling, Meike Stiesch   Venue: Salon 6

09:00-09:20   Characterization and modeling of permanent implants based on innovative in vivo, in vitro and in silico methods
Marco Zimpel, Jochen Tenkamp, Mirko Teschke, Frank Walther

09:20-09:40   Process parameter development for additively manufactured lattice structures for dental implants
Anne Jahn, Nicole Emminghaus, Stefan Kaierle, Jörg Hermsdorf

09:40-10:00   Mechanism-based characterization of additively manufactured Ti6Al4V alloy for application in medical implants with customized functionality
Mirko Teschke, Lorenz Grafe, Sebastian Stammkötter, Marco Zimpel, Jochen Tenkamp, Frank Walther

10:00-10:20   The effects of different grading approaches on peri-implant bone stress in additively manufactured dental implants: a finite element analysis
Osman Akbas, Meike Stiesch, Andreas Greuling

10:20-10:40   Influence of different surface roughnesses on osteogenic differentiation and inflammatory processes of titanium implants
Florian Gamon, Sandra Fuest, Martin Gosau, Ralf Smeets

10:40-11:00   Protein adsorption on biomaterials
Tonya Andreeva, Mirijam Schäfer, Ole Jung, Mike Barbeck, Rumen Krastev

11:00-11:20   Coffee Break

11:20-11:40   Regulation of protein conformation on surfaces with controlled properties
Tonya Andreeva, Rumen Krastev

11:40-12:00   Applications of titanium/ magnesium based biomaterials in oral and maxillofacial surgery - what can we expect?
Ralf Smeets, Sandra Fuest, Florian Gamon, Martin Gosau, Rico Rutkowski

12:00-12:20   Influence of different surface roughnesses on osteogenic differentiation and inflammatory processes of titanium implants
Florian Gamon, Sandra Fuest, Martin Gosau, Ralf Smeets

12:20-12:40   Bacterial adhesion to dental surfaces and implants
Klemen Bohinc

12:40-13:00   Biological assessment of titanium implants - comparison of grade 4 and 5 titanium
M. Schäfer, A. Jung, A. Foth, S. Emmert, M. Barbeck, O. Jung

13:00-13:20   Experimental and numerical investigations on the mechanical as well as damage behavior of additively manufactured TiA16V4 porous structures
Wiebke Radolf, Christian Polley, Chrisopher Benz, Hermann Seitz, Manuela Sander

13:20-13:40   A rate-dependent elasto-plastic gradient-enhanced damage model at microscale
Hüray Ilayda Kök, Philipp Junker

13:40-14:00   Closing

Congress Dinner

Tuesday, 7th November 2023
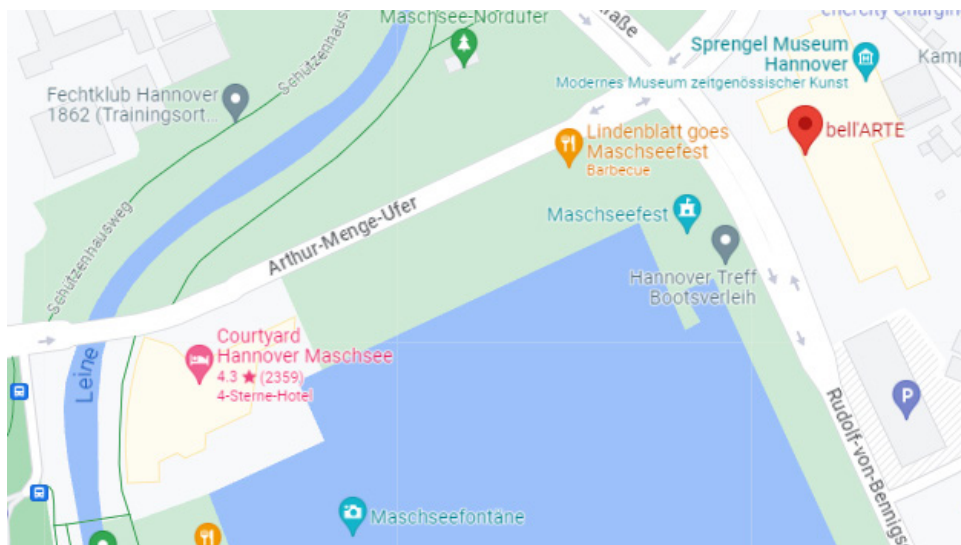
20:00   bell´ARTE

The ICBT 2023 dines at the restaurant bell´ARTE in the Sprengel Museum, within walking distance of the conference hotel. We enjoy the view of the Lake Maschsee and a delicious buffet.

Venue:
bell´ARTE at Sprengel Museum
Kurt-Schwitters-Platz 1
30169 Hannover

General Information

Acknowledgements

The conference organizers acknowledge the support towards the organization of the ICBT 2023 to the following organizations:

Int. Association for Applied Mathematics and Mechanics (GAMM)

Hannover Medical School

Helmholtz

Leibniz Universität Hannover, Germany

European Community on Computational Methods in Applied Sciences (ECCOMAS)

German Association for Computational Mechanics (GACM)

Registration

Conference registration will start on Monday, November 6th, at 8 a.m. in the foyer of the Courtyard by Marriot Hotel Hannover Maschsee (Arthur-Menge-Ufer 3, 30169 Hannover)

Presentation: Time & Equipment

Each regular presentation is allocated to 20 minutes and each plenary lecture presentation is allocated to 40 minutes - including questions & answers.

A computer (Windows) and a projector will be available in each room, please bring your talk on a USB-stick. Presentations should be uploaded (directly in the lecture rooms) and tested during the break preceding the session.

Useful numbers

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www.hannover.de

Taxi
Tel.: + 49 (0) 511 / 38 11
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Airport Hannover
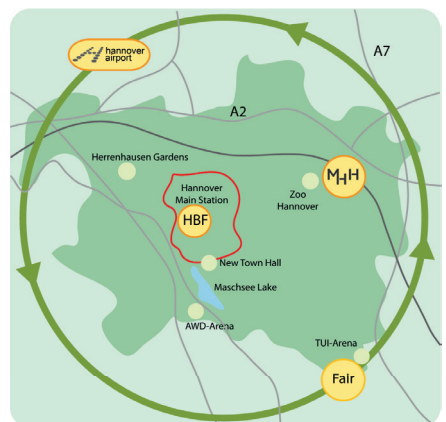www.hannover-airport.de

Hannover Main Station
www.bahn.de

UESTRA Public Transport
www.uestra.de

- Not all taxi drivers accept credit cards!
- Currency in Germany is € (Euro).
- Germany Time: Central European Winter Time (CEST) = GMT + 1
- Power supply: In Germany the power sockets are of type F. This socket also works with plug C and plug E.


By bus, tram and rail through Hannover and the Hannover Region easy with public transport.

The Red Thread is painted on the pavement, and weaves its way through the inner city joining up 36 prime attractions.

Venue:

The conference will be held at Courtyard by Marriot Hotel Hannover Machsee. Presentations will be split in two lecture rooms (Salon 5 and Salon 6). Wireless connection is available in the hotel.
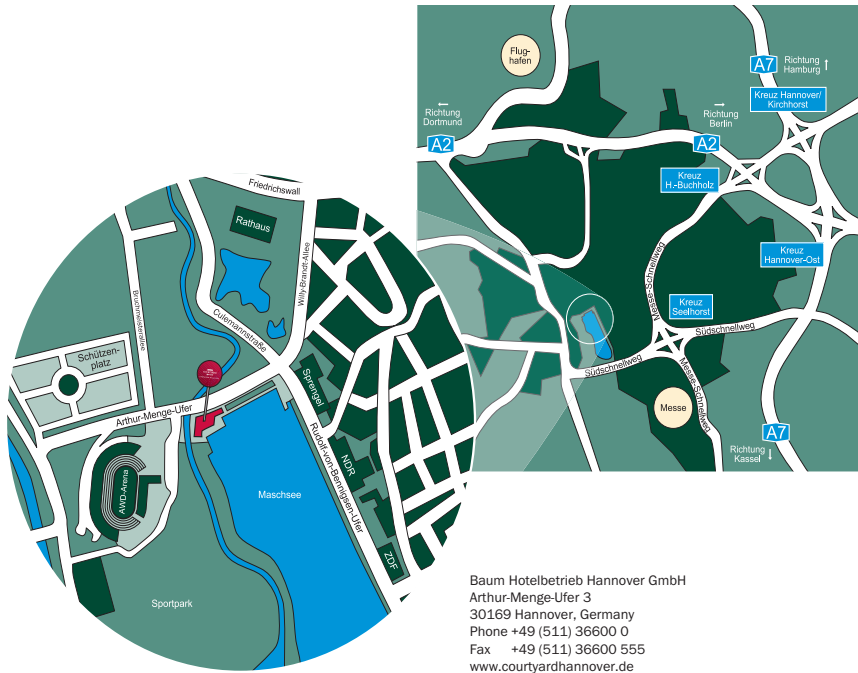
Baum Hotelbetrieb Hannover GmbH
Arthur-Menge-Ufer 3
30169 Hannover, Germany
Phone +49 (511) 36600 0
Fax   +49 (511) 36600 555
www.courtyardhannover.de

Discover Hannover

Hannover, one of the greenest cities in Europe, has a long historical tradition. The capital of Lower Saxony, with around 500,000 inhabitants, has many attractions such as the royal baroque gardens in Herrenhausen (winner of the European Garden Award 2015), the Maschsee Lake, the Hannover Adventure Zoo and the Eilenriede city forest, Hannover's 'green lung'.

There are also a number of museums dedicated to modern art and design, as well as cultural institutions exploring Hannover's historical background, including the Gottfried Wilhelm Leibniz library. Hannover is a friendly city with many pubs, a car-free historic center and numerous shopping facilities.

The Leibniz Universität Hannover is one of Germany's TU9 universities. Hannover is also home of the Hannover Medical School and the University of Veterinary Medicine. Hannover can boast a thriving scientific community.

Leibniz Universität Hannover

Shaping the Future with Knowledge – as one of the nine leading Institutes of Technology in Germany, Leibniz University is aware of its responsibility in seeking sustainable, peaceful and responsible solutions to the key issues of tomorrow.
Our expertise for this stems from the broad spectrum of subjects, ranging from engineering and natural sciences to architecture and environmental planning, from law and economics to social sciences and humanities.

At Leibniz University there are currently almost 30,000 students studying in nine faculties, and some 3,100 researchers working in more than 180 institutes. The main building of the university is the Royal Palace Welfenschloss at the Welfengarten. Our internationally visible core research topics are in mechanical engineering, in quantum optics and gravitational physics, in biomedical research and in teacher training. The broad range of subjects at Leibniz University is entirely compatible with an overall university strategy of raising its profile, in particular of teaching and research, including the establishment and enhancement of research priority areas originating in the humanities and social sciences. Cooperation agreements with national and international partners strengthen our scientific expertise – our most important partner is Hannover Medical School (MHH). By adopting the name of the polymath Gottfried Wilhelm Leibniz in 2006, the university committed itself to unity in its diversity.

Hannover Medical School

The Department of Otorhinolaryngology at Hannover Medical School (MHH) is internationally renowned for hosting the world's largest cochlear implant (CI) programme to treat severely hearing impaired patients. To date, more than 11,000 people have received a CI here. One of our priority areas, therefore, is provision of hearing systems – from the development of the devices themselves to lifelong support for our patients. Together, the German Hearing Center Hannover and the scientific laboratories form the joint platform for these activities.

Other priority areas include hearing-aid fitting (and improving this process), the early identification of hearing loss in children, diagnosis and treatment of inner-ear diseases including tinnitus, skull base surgery including treatment of acoustic neu¬roma, tumour surgery using modern laser surgical and endoscopic techniques, diseases of the nose and sinuses, covering allergology, environmental medicine and plastic/reconstructive techniques.

Our Department has six wards with a total of 90 beds. Each year we treat around 25,000 outpatients and just under 6,000 inpatients. A highly motivated and specialised team is available, with more than 200 staff – including 30 doctors, 20 nurses, nine education professionals and speech therapists, 20 technical staff and 30 scientists.

Our case numbers: more than 600 cochlear implants, 85 middle-ear implants and 100 acoustic neuromas in 2022.

About ECCOMAS

Mission
The mission of ECCOMAS is to promote joint efforts of European universities, research institutes and industries which are active in the broader field of Numerical Methods and Computer Simulations in Engineering and Applied Sciences

Action Plan

- Extend the positive momentum of ECCOMAS activities in the fields of Computational Solid and Structural Mechanics as well as Fluid Dynamics to other fields in the scientific spectrum of the association, such as for example Acoustics, Electromagnetics, Applied Physics and Chemistry, Applied Mathematics and Scientific Computing, etc.

- Increase efforts on building more bridges between industry and academia by integrating contributions of industry and encourage the participation from academia to industry oriented meetings, e.g. user's conferences, or, alternately, by organizing industrial-driven conferences; when applicable for specific technological fields, like for automotive industry, aeronautics, turbo-machinery, structural engineering, etc. Reactivate the Industrial Liaison Activity Committee.

- Strengthen the role of the technical committees as working bodies in the individual fields within all ECCOMAS activities, such as promoting scientific discussions, developing visions in the field, nominating plenary and semiplenary lectures and organizing minisymposia at ECCOMAS Congresses and Conferences, proposing thematic conferences as well as advanced schools and courses and assisting in their organization, etc.

- Increase the involvement of young investigators in the activities of ECCOMAS through participation in related tasks and decision processes, organization of future Young Investigator Conferences (YIC) and Olympiads, support of corresponding young investigator meetings on national and regional levels, developments of summer schools as well as workshops, and courses, e.g. before and after conferences.

- Enhance the involvement of scientists from the new countries of EU as well as from other European countries on the activities of ECCOMAS . This can be achieved by the organization of scientific events in these countries and by facilitating the participation of young scientists to the activities of ECCOMAS .

- Enhance the cooperation of ECCOMAS with other European, regional and international organizations and scientific and technical societies with joint scientific and technological events.

- Initiate activities for improving the European educational system by encouraging the cooperation between Universities for joint courses and for fostering the interdisciplinary study that computational modeling and simulation requires today.

See also www.eccomas.org/about/mission/

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https://icbt-hannover.com/