European Community on
Computational Methods in
Applied Sciences

ECCOMAS

ECCOMAS Congress 2016

VII European Congress
on Computational Methods in Applied Sciences
and Engineering

June 5-10, Crete, Greece

PROGRAMME

ECCOMAS CRETE 2016 CONGRESS

TECHNICAL SESSIONS

Tuesday, June 7
14:30-16:30
Zeus East

MS 105 - 1: SIMULATION OF CARDIOVASCULAR PROCEDURES AND DEVICES

MS Organizers: Ferdinando Auricchio, Michele Conti, Simone Morganti, Alessandro Reali, Alessandro Veneziani
Chair: Alexander Popp

6413 KEYNOTE: BOTTOM-UP MODELING OF AAA STENT GRAFTS AND STENT PLACEMENT PROCEDURES
Alexander Popp, Marie Oshima

11945 SUTURE-TYPE AFFECTS THE HAEMODYNAMIC PERFORMANCE OF AORTIC VALVE SUBSTITUTES
Claudio Capelli, E. Sauvage, C. Corsini, S. Schievano, M. Andreas, G. Burriesci, C. Rath

7812 FLUID–STRUCTURE INTERACTION ANALYSIS OF PATIENT-SPECIFIC HEART VALVES
Fei Xu, **Michael Cheng-Hao Wu**, Ming-Chen Hsu, Simone Morganti, Alessandro Reali, Ferdinando Auricchio, Josef Kiendl, David Kamensky

8702 SIMULATING ASCENDING AORTA ENDOGRAFTING IN A DYNAMIC HEART MODEL
Jakub Kwiecinski, Zhong You, Raman Uberoi

Tuesday, June 7
14:30-16:30
Zeus West

MS 112 - 1: ANEURYSMS: SOLID MECHANICS, FLUID MECHANICS, AND MECHANOBIOLOGY

MS Organizers: Christian J. Cyron, Sven Hirsch, Philippe Bijlenga, Roland C. Aydin, Anne M. Robertson, Gerhard A. Holzapfel
Chair: Christian J. Cyron, Gerhard A. Holzapfel

7548 KEYNOTE: A BIOCHEMOMECHANICAL ROLE OF THROMBUS IN
Humphrey
Paolo Di Achille, John Wilson, Lana Virag, Igor Karsaj, **Jay Humphrey**

9021 RELATIVE ROLES OF MECHANICS AND BIOCHEMISTRY IN THE INITIATION AND PROGRESSION OF CEREBRAL ANEURYSM THROMBOSIS
Malebogo Ngoepe, Yiannis Ventikos

9034 MULTISCALE NUMERICAL METHODS FOR AORTIC ANEURYSM AND THORACIC ANEURYSM
Alireza Yazdani, He Li, Jay Humphrey, George Karniadakis

7921 EARLY EVENTS OF DISSECTING ABDOMINAL AORTIC ANEURYSM IN ANGIOTENSIN II-INFUSED APOE -/- MICE
Lydia Aslanidou, Bram Trachet, Alessandra Piersigilli, Alexis Dorier, Arnaud Leclerc, Rodrigo Fraga-Silva, Alberto Astolfo, Marco Stampanoni, Patrick Segers, Nikolaos Stergiopoulos

7149 SYNCHROTRON IMAGING OF DISSECTING ABDOMINAL AORTIC ANEURYSM IN ANGIOTENSIN II-INFUSED APOE -/- MICE
Bram Trachet, Rodrigo Fraga-Silva, Alessandra Piersigilli, Lydia Aslanidou, Alberto Astolfo, Marco Stampanoni, Patrick Segers, Stergiopoulos

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Tuesday, June 7
14:30-16:30
Zeus North

MS 901 - 1: ISOGEOMETRIC METHODS

MS Organizers: Yuri Bazilevs, David J. Benson, Rene De Borst, Thomas J.R. Hughes, Trond Kvamsdal, Alessandro Reali, Giancarlo Sangalli, Clemens V. Verhoosel
Chair: Thomas J.R. Hughes

9994 KEYNOTE: HIERARCHIC ISOGEOMETRIC GEOMETRICALLY LINEAR AND NONLINEAR SHELL ELEMENTS
Bastian Oesterle, Ekkehard Ramm, Manfred Bischoff

6345 COMPUTATIONAL ASPECTS OF MORPHOLOGICAL INSTABILITIES USING ISOGEOMETRIC ANALYSIS
Berkin Dortdivanlioglu, Ali Javili, Christian Linder

7488 ON DUAL BASIS FUNCTIONS FOR THE ISOGEOMETRIC MORTAR METHOD
Wolfgang Dornisch, Ralf Müller

9877 LOCKING FREE ISOGEOMETRIC STRUCTURAL ELEMENTS PRESERVING SPARSITY OF STIFFNESS MATRICES
Bastian Oesterle, Ekkehard Ramm, Manfred Bischoff

10902 G^1 POLAR SPLINE PATCHES
Deepesh Toshniwal, Hendrik Speleers, Thomas J R Hughes

Tuesday, June 7
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Minos East

MS 501 - 4: ALGORITHMIC ASPECTS OF HIGH-PERFORMANCE COMPUTING FOR MECHANICS AND PHYSICS

MS Organizers: Santiago Badia, Victor Calo, Javier Principe
Chair: Joan Baiges

4974 KEYNOTE: TOWARDS SPACE-TIME ITERATIVE SOLVERS BASED ON BALANCING DOMAIN DECOMPOSITION
Santiago Badia, Marc Olm

8377 EFFECT OF ADAPTIVE MESH REFINEMENT ON A PARALLEL NON-OVERLAPPING DOMAIN DECOMPOSITION SOLVER
Pavel Kus, **Jakub Sistek**

10290 HYBRID PARALLELISATION OF AN ALGORITHMICALLY DIFFERENTIATED ADJOINT SOLVER
Pavankumar Mohanamurahy, Jan Christian Huckelheim, Jens-Dominik Mueller

10933 PERFORMANCE TUNING OF SUBDOMAIN LOCAL FE SOLVER IN DOMAIN DECOMPOSITION METHOD
Hiroshi Kawai, Masao Ogino, Ryuji Shioya, Tomonori Yamada, Shinobu Yoshimura

4625 BLOCK ITERATIVE METHODS AND RECYCLING FOR IMPROVED SCALABILITY OF LINEAR SOLVERS
Pierre Jolivet, Pierre-Henri Tournier

Tuesday, June 7
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Minos North

MS 301 - 2: METHODS FOR CUT AND COMPOSITE MESHES: THEORY, ALGORITHMS AND APPLICATIONS

MS Organizers: Mats G. Larson, André Massing
Chair: André Massing

6701 ACCURATE INTEGRATION IN CUT ELEMENTS BASED ON CONFORMAL DECOMPOSITION INTO ISOPARAMETRIC ELEMENTS
Thomas-Peter Fries

5997 CAN EMBEDDED BOUNDARY GRIDS COMPUTE HIGH REYNOLDS NUMBER FLOW?
Marsha Berger

6531 CUT FINITE ELEMENT MODELING OF EMBEDDED LOWER-DIMENSIONAL ELASTICITY MODELS
Mirza Cenanovic, **Peter Hansbo**, Mats G. Larson

7082 DIRECT NUMERICAL SIMULATION OF PARTICULATE FLOWS USING A DISCONTINUOUS GALERKIN IMMERSED BOUNDARY METHOD
Dennis Krause, Florian Kummer

6235 HIGHER ORDER CUT-ELEMENTS FOR WAVE PROPAGATION
Simon Sticko, Gunilla Kreiss

Tuesday, June 7
14:30-16:30
Minos South

MS 503 - 4: HPC-BASED SIMULATIONS FOR THE ENGINEERING REALM AND INDUSTRIAL APPLICATIONS

MS Organizers: Makoto Tsubokura, Mariano Vázquez, Takayuki Aoki
Chair: Andreas Lintermann

7982 AERODYNAMICS STUDY USING LOCALLY MESH-REFINED LATTICE BOLTZMANN METHOD FOR A GPU COMPUTATION
Yuta Hasegawa, Takayuki Aoki, Hiromichi Kobayashi

8316 HPC-BASED LES OF WIND FLOW OVER LARGE URBAN AREA WITH SLIGHT UNDULATION
Hidenori Kawai, Tetsuro Tamura, Keiji Onishi, Rahul Bale, Makoto Tsubokura, Koji Kondo, Tsuyoshi Nozu, Kazuaki Uchibori

8375 SCALABLE IMMERSED BOUNDARY METHOD FOR LARGE SCALE SIMULATIONS WITH MOVING IMMERSED STRUCTURES.
Rahul Bale, Niclas Jansson, Keiji Onishi, Makoto Tsubokura

8436 HPC ADAPTIVE FINITE ELEMENT SIMULATION OF FLUID DYNAMICS AND FLUID-STRUCTURE INTERACTION IN INDUSTRIAL APPLICATIONS
Johan Hoffman, Johan Jansson, Niclas Jansson, Rodrigo Vilela De Abreu

11990 INDUCED SHOCK WAVE / LAMINAR BOUNDARY LAYER INTERACTION
Hasan Avsar, Bayram Celik

Tuesday, June 7
14:30-16:30
Danae

MS 1001 - 3: STRUCTURAL AND MULTIDISCIPLINARY OPTIMIZATION

MS Organizers: J.F. Aguilar Madeira, Helder C. Rodrigues
Chair: Matteo Bruggi

10127 KEYNOTE: MASS MINIMIZATION OF MULTI-MATERIAL LAMINATED COMPOSITES WITH FAILURE CONSTRAINTS
Erik Lund

10084 GRADIENT BASED STRUCTURAL OPTIMIZATION OF JACKET STRUCTURES WITH FATIGUE AND ULTIMATE LIMIT STATE CONSTRAINTS FOR OFFSHORE WIND TURBINES
Jacob Oest, René Sørensen, Lars Chr. T. Overgaard, Erik Lund

11364 OPTIMIZATION OF A STIFFNESS MEASURE OF HYBRID FIBER COMPOSITE MATERIALS.
Filipe J.S. Leal, **José M. Guedes**, Helder C. Rodrigues

11437 QUASI-NEWTON AND BFGS-LIKE METHOD FOR PDE-CONSTRAINED SHAPE OPTIMIZATION
Jean-Léopold Vié, Eric Cancès, Grégoire Allaire

10606 EFFICIENT SIZING OF STRUCTURES UNDER STRESS CONSTRAINTS
Zhi Hong, Mostafa Abdalla

Tuesday, June 7
14:30-16:30
Europa

CS 410 - 2: COMPUTATIONAL FLUID MECHANICS
Chair: Horia Dumitrescu

4822 THE VORTICITY CREATION PROCESS AT PHYSICAL SURFACES
Horia Dumitrescu, Vladimir Cardos

11128 INVESTIGATION OF END-WALL EFFECTS ON LOW PRESSURE TURBINES BY USING LARGE-EDDY SIMULATION
Dogukan Tugberk Karahan, Seyfullah Cay, Ayse Gul Gungor

11098 THE OPTIMAL CONTROL OF A MULTI-MASS VIBRATION PROPULSION SYSTEM IN A VISCOUS INCOMPRESSIBLE FLUID
Artem Nuriev, Zakharova Olga

11224 HIGH-RESOLUTION SIMULATION OF INTERACTION OF HIGH AMPLITUDE INTERNAL WAVES WITH WALLS ON DYNAMICS OF WAVES ATTRACTORS
Ilias Sibgatullin, Michael Kalugin

EARLY EVENTS OF DISSECTING ABDOMINAL AORTIC ANEURYSM IN ANGIOTENSIN II-INFUSED APOE -/- MICE

Lydia Aslanidou, Bram Trachet, Alessandra Piersigilli, Alexis Dorier, Arnaud Leclerc, Rodrigo Fraga-Silva, Alberto Astolfo, Marco Stampanoni, Nikolaos Stergiopulos, Patrick Segers

Angiotensin-II infusion in ApoE deficient mice has been a mainstay of preclinical research on abdominal aortic aneurysm (AAA). Recent findings from our group, based on synchrotron images with an isotropic resolution of 6.5 micron and soft tissue image contrast, suggested a pivotal role for microruptures near small side branches in the development of the disease in mice. In this work we provide further insight in the processes occurring near these branches at a very early stage of dissecting AAA formation. We scanned n=10 Ang-II infused and n=6 control male mice with high-frequency ultrasound and contrast-enhanced microCT. Animals were sacrificed after 3 days of angiotensin II infusion, prior to the formation of an intramural hematoma or a false channel. The aortic tissues were excised and imaged ex-vivo using phase contrast X-ray tomographic microscopy (PCXTM). Segmentation of the high-resolution images yielded a 3D representation of the aorta. The micro-CT contrast agent (Exitron) was visible on the ex-vivo images in 7/10 animals. Exitron had migrated in-vivo at the sites of microruptures near side branches. PCXTM image-guided histology was performed to obtain Hematoxylin and Eosin slides of the aorta at the location of all branch orifices, as well as at control regions in between branch sites. As shown in Figure 1, the identified microlesions include, but were not limited to: (i) ruptures of the elastin lamellae of the tunica media, (ii) apoptotic cell appearance and (iii) presence of fatty streaks. We also quantified medial thickness and averaged nucleic density of the vascular smooth muscle cells near all branching points along the aorta, for all samples. In conclusion, high-resolution imaging of early-stage dissecting abdominal aortic aneurysms confirmed the role of small suprarenal side branches in the onset of the disease. Further research will include fluid-structure interaction simulations to relate branch-related stresses to the locations where micro-ruptures occur.