E CCOMAS

ECCOMAS Congress 2016

VII European Congress
on Computational Methods in Applied Sciences
and Engineering

June 5-10, Crete, Greece

PROGRAMME

ECCOMAS
CRETE
2016
CONGRESS

MS 105 - 1: SIMULATION OF CARDIOVASCULAR PROCEDURES AND DEVICES

Tuesday, June 7
14:30-16:30

Zeus East

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

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

Chair: Alexander Popp

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

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

Tuesday, June 7
14:30-16:30

Zeus West

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 ABDOMINAL AORTIC ANEURYSMS
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 Vazdani, 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, Nikolaos Stergiopoulos

MS 901 - 1: ISOGEOMETRIC METHODS

Tuesday, June 7
14:30-16:30

Zeus North

MS Organizers: Thomas J.R. Hughes

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

Chair: Thomas J.R. Hughes

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

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

Tuesday, June 7
14:30-16:30

Minos East

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 Sístek**

10290 HYBRID PARALLELISATION OF AN ALGORITHMICALLY DIFFERENTIATED ADJOINT SOLVER
Pavankumar Mohanamuraly, 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

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

Tuesday, June 7
14:30-16:30

Minos North

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

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

Tuesday, June 7
14:30-16:30

Minos South

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

MS 1001 - 3: STRUCTURAL AND MULTIDISCIPLINARY OPTIMIZATION

Tuesday, June 7
14:30-16:30

Danae

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. Overgard, 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

CS 410 - 2: COMPUTATIONAL FLUID MECHANICS

Tuesday, June 7
14:30-16:30

Europa

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 INTERNAL WAVES ATTRACTORS AND IMPACT OF INTERACTION OF HIGH AMPLITUDE INTERNAL WAVES WITH WALLS ON DYNAMICS OF WAVES ATTRACTORS
Ilias Sibgatullin, Michael Kalugin

SYNCHROTRON IMAGING OF DISSECTING ABDOMINAL AORTIC ANEURYSMSM IN ANGIOTENSIN II-INFUSED APOE -/- MICE

Bram Trachet[1, 2*], Rodrigo Fraga-Silva[2], Alessandra Piersigilli[2], Lydia Aslanidou[2], Alberto Astolfo[3], Marco Stampanoni[3], Nikolaos Stergiopulos[2], Patrick Segers[1]

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ABSTRACT

Background: Angiotensin II-infused ApoE -/- mice are often used to study abdominal aortic aneurysm (AAA). However, there is ongoing discussion to what extent these mice mimic human aneurysms. The goal of this work was to visualize and classify the abdominal lesions of angiotensin II-infused mice using a synchrotron-based ex vivo imaging technique. To that end we followed n=36 male mice in vivo with high-frequency ultrasound and contrast-enhanced micro-CT. Animals that did not die from aneurysm rupture were sacrificed after 10 (n=4), 18 (n=5) and 29 (n=13) days of angiotensin II infusion. Aortic samples of 34/36 mice, comprising the descending, thoracic as well as abdominal aorta, were scanned ex vivo using phase contrast X-ray tomographic microscopy (PCXTM). This is a novel imaging technique that combines soft tissue image contrast with a 6.5 micron isotropic resolution. **Results:** We quantified and classified three features of dissecting AAAs on the ex vivo PCXTM images: (i) micro-ruptures near side branches, as evidenced by the infiltration of ExiTron contrast agent that had been injected in vivo, (ii) false channel formation near side branches (iii) intramural hematoma formation near side branches. In the in vivo part of our study 25/34 animals had been injected with ExiTron. Of these samples, Exitron was found within the tunica media in the vicinity of 151/423 side branches, showing that these are an important target for the pathology. An intramural hematoma was observed in 23/34 scanned samples. The number of ruptured side branches leaving the hematoma correlated better to hematoma length (r^2=0.59) than to hematoma volume (r^2=0.44). Finally, one or several false channels were observed in 20/34 samples. The size of the tear in the tunica media (invariably occurring near the branches) and its interaction with the surrounding hematoma determine the occurrence, shape and size of the false channel. **Conclusion(s):** Our data provide new insight into the branch-related anatomy of dissecting abdominal aortic aneurysms in angiotensin II-infused ApoE -/- mice. Further research is needed to elucidate the relevance and translational value of this popular mouse model.