

Meshing, Visualization, and Computational Environments

Papers Presented at the AIAA SciTech Forum and Exposition
2022

San Diego, California, USA and Online
3 - 7 January 2022

ISBN: 978-1-7138-5401-2

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

The contents of this work are copyrighted and additional reproduction in whole or in part are expressly prohibited without the prior written permission of the Publisher or copyright holder. The resale of the entire proceeding as received from CURRAN is permitted.

For reprint permission, please contact AIAA's Business Manager, Technical Papers. Contact by phone at 703-264-7500; fax at 703-264-7551 or by mail at 34922 Uwytkug'Xcmg{'Ftkxg.'Uwky'422, Reston, VA 20191, USA.

TABLE OF CONTENTS

MESHING TECHNIQUES

Overlap Preservation Using Loosely-Coupled Boundary Conditions for Body-Fitted Structured Overset Grids.....	1
<i>Andrew M. Chuen, William M. Chan</i>	
Numerical Analysis of an Optimized Wind Turbine Blade.....	24
<i>Ravi P. Singh, Praveen Kumar, Gurjeev S. Sangha, Zozimus D. Labana</i>	
Angle-of-Attack Sweep with Mesh Adaptation for High-Lift Configurations.....	36
<i>Aravind Balan, Michael A. Park, Stephen L. Wood, William K. Anderson, Kevin Jacobson</i>	
NURBS-Based Geometry Repair in Capstone	69
<i>William Szymczak, Saikat Dey, Mauricio Villa, Eric Mestreau, Romain Aubry, Michael Williamschen</i>	
Defect Correction on Unstructured Finite Volume Solvers.....	81
<i>Akhil Jayasankar, Carl F. Ollivier Gooch</i>	

APPLIED MESHING FOR REAL-WORLD AND AIAA WORKSHOP APPLICATIONS

Exploring Tie Constraints for Structural Analysis Problems	92
<i>Paul Mokotoff, John Dannenhoffer</i>	
Some Progress on CFD High Lift Prediction using Metric-based Anisotropic Mesh Adaptation.....	109
<i>Frederic Alauzet, Francesco Clerici, Adrien Loseille, Cosimo Tarsia-Morisco, Julien Vanharen</i>	
Developments on the P2 Cavity Operator and Bézier Jacobian Correction using the Simplex Algorithm.	129
<i>Adrien Loseille, Lucien Rochery</i>	

COMPUTATIONAL TECHNIQUES AND FRAMEWORKS

Parallelization Strategies for Efficiently Computing CAD-based Sensitivities for Design Optimization.....	145
<i>John Dannenhoffer</i>	
Performance of Coupled Physics Solvers for Multidisciplinary Hypersonic Flow Simulations on Several Classes of Computer Architectures	158
<i>David A. Kessler, Andrew M. Hess, Keith Obenschain, David C. Eder, Alice Koniges, Anthony Knutson, Graham V. Candler, Heath Johnson, Spencer Starr, Joel Bretheim, Kevin Roe, Eric J. Nielsen, Aaron Walden, Gabriel Nastac, Kevin Jacobson, Roy Campbell, David R. McDaniel, Ryan B. Bond</i>	
Integrated Framework for Smart Adaptive Mesh Refinement and Mesh Motion with NEMoSys.....	176
<i>Akash A. Patel, Mohammad Mehrabadi, Alessandro Gondolo</i>	

GEOMETRY MODELLING FOR PHYSICS-BASED ANALYSES

A Parametric G1-continuous Rounded Wing Tip Treatment for Preliminary Aircraft Design	185
<i>Marshall C. Galbraith, Robert Haimes</i>	
Towards Modeling for Design: Aspects of Multi-fidelity Geometry using CAPS.....	201
<i>Nitin D. Bhagat, Ryan Durscher, Dean E. Bryson</i>	
On Analysis Driven Shape Design Using B-Splines	213
<i>Marlena Gomez, Robert Haimes, Marshall C. Galbraith</i>	
A Python Extension Module for Parametric Geometry Generation with Sensitivities	231
<i>Ryan J. Durscher, Marco Kobayashi, Nitin D. Bhagat</i>	

ADAPTIVE MESHING, ERROR ESTIMATION, AND UNCERTAINTY QUANTIFICATION I

Enabling Metric-based Mesh Adaptation for Advanced Compressible Flow Simulations using US3D.....	252
<i>Dirk Ekelschot, Joesph Brock</i>	
Output-Based Mesh Adaptation Using Overset Methods for Structured Meshes	270
<i>Alexander Coppeans, Krzysztof Fidkowski, Joaquim R. Martins</i>	

VISUALIZATION, INCLUDING FEATURE DETECTION, KNOWLEDGE EXTRACTION AND CAPTURE

Using ViZiR 4 to Analyze the 4th AIAA CFD High Lift Prediction Workshop Simulations.....	285
<i>Matthieu Maunoury, Rémi Feuillet, Adrien Loseille</i>	
Application of Machine Learning to Automate Flow Separation Identification in Computed Solutions.....	304
<i>Rudraksh Nathan</i>	
Towards Modeling for Design: Using Real-time Collaborative Environment in CAPS	316
<i>Nitin D. Bhagat, John Dannenhoffer</i>	

ADAPTIVE MESHING, ERROR ESTIMATION, AND UNCERTAINTY QUANTIFICATION II

Coupled Adjoint Solver and Turbulent Error Estimate for Anisotropic Mesh Adaptation for High-fidelity RANS Simulations.....	327
<i>Francesco Clerici, Philippe Spalart, Frederic Alauzet</i>	
Initial Mesh Generation for Solution-Adaptive Methods Using Machine Learning	349
<i>Vivek Ojha, Guodong Chen, Krzysztof Fidkowski</i>	
Anisotropic Goal-Based Mesh Adaptation Metric Clarification and Development	366
<i>Dmitry S. Kamenetskiy, Joshua A. Krakos, Todd R. Michal, Francesco Clerici, Frederic Alauzet, Adrien Loseille, Michael A. Park, Stephen L. Wood, Aravind Balan, Marshall C. Galbraith</i>	
Quasi-structured Anisotropic Quad-dominant Mesh Adaptation using Metric-orthogonal Approach.....	390
<i>Lucille-Marie Tenkes, Adrien Loseille, Frederic Alauzet</i>	

COMPUTATIONAL MESHING AND VISUALIZATION TECHNIQUES

Assessment of Adjoint-based Adaptive Mesh Refinement Strategies for Steady RANS	407
<i>Marian Zastawny, Massimo Biava</i>	
A Spatial Arrangement Visualisation Strategy for Learning from Large Ensembles of Unsteady Flow-field Data.....	422
<i>Aljaz Kotnik, Graham Pullan</i>	
Development of Surrogate Model to Predict Errors in FEM solutions using Deep Convolutional Neural Networks.....	435
<i>Siddharth Jain, Rakesh K. Kapania, Daniel Hammerand</i>	

Author Index