

Non-Deterministic Approaches

Papers Presented at the AIAA SCITECH 2026 Forum

Orlando, Florida, USA
12 - 16 January 2026

ISBN: 979-8-3313-3509-0

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

A Novel High-Dimensional Gradient-Based Robust Optimization Framework Applied to Adjoint-Based CFD Applications	1
<i>Imane Fadli, Joël Brezillon, Jean-Christophe Jouhaud</i>	
A Stochastic Framework for Multiaxial Fatigue Analysis of Composite Structures Under Variable Amplitude Loading.....	19
<i>Jafar Sadique Pilakkadan, Mishal Thapa, Sameer B. Mulani</i>	
Efficient Uncertainty Quantification for Aircraft Conceptual Design Using Polynomial Chaos Expansion.....	40
<i>Colton Campbell, Sameer B. Mulani, Mishal Thapa, Semih M. Olcmen</i>	
Global Sensitivity Analysis of Discontinuous Responses Using Domain Decomposition	75
<i>Mishal Thapa, Sameer B. Mulani</i>	
Towards a Modular Framework for Aircraft Multidisciplinary Design Under Uncertainty	93
<i>Philip M. Renkert, Edwin E. Forster</i>	
Uncertainty Quantification and Sensitivity Analysis of Spalart Allmaras and Menter Shear Stress Model Coefficients for NACA 0012 Airfoil	114
<i>Angad Sahni, Saleh Rezaeiravesh</i>	
Higher Order Quantum Reservoir Computing for Non-Intrusive Reduced-Order Models	126
<i>Vinamr Jain, Romit Maulik</i>	
Federated Digital Twins for Space Systems	143
<i>Sebastian Henao-Garcia, Michael Kapteyn, Karen E. Willcox</i>	
Comparison of Gradient-based and Global Autoencoded Lift-constrained Drag Minimizations.....	157
<i>Kazuko Fuchi, Markus Rumpfkeil, Phil Beran, Dean E. Bryson</i>	
Advancements in Reduced Order Model-Based Multifidelity Uncertainty Quantification for High-Speed Flows	169
<i>Anthony Gruber, Gianluca Geraci, Patrick J. Blonigan, Eric Parish, Michael Eldred</i>	
Non-Intrusive Reduced Order Modeling of Aerothermal Field Data Including Ablation Shape Change.....	193
<i>Jacob T. Needels, Patrick J. Blonigan, Jonathan C. Murray, John Tencer, Matthew Barone</i>	
A Physics Informed Neural Network Framework for Optimization of Functionally Graded Materials for Aerostructural Systems	206
<i>Zekeriya Ender Eger, Pinar Acar</i>	
Physics-Informed Machine Learning for Characterizing System Stability	221
<i>Tomoki Koike, Elizabeth Qian</i>	
Data-Driven Non-Central Wishart Framework for Hybrid Uncertainty Quantification of Aerostructures	234
<i>Alan D. Mannoosseril, Sondipon Adhikari</i>	

Optimal Experimental Design to Improve System-Level Predictions with Mission-Level Data under Uncertainty	254
<i>Diane C. Villanueva, Clarissa Hoyt, Connor Morehead, Aleksandra Markina-Khusid, Anirban Chaudhuri</i>	
Multi-Resolution Digital Twins Under Uncertainty With Applications to Multiscale Systems	264
<i>Stefanos Pyrialakos, Anirban Chaudhuri, Karen E. Willcox</i>	
Probabilistic Surrogate Modeling and Uncertainty Quantification for Aviation Fleet Emissions	282
<i>Nitya Maruthuvakudi Venkatram, Burak Bagdatli, Dimitri Mavris</i>	
Nodal Framework Modeling for System-Level Reliability Analysis	296
<i>Tyler Schostek, Davide Ziviani</i>	
Some Conservative and Efficient Sparse-Sample Tail Probability Estimation Methods and Practical Motivation for Them	310
<i>Vicente J. Romero, Charles Jekel</i>	
Certification of Dynamical System Models Using End-to-End Distributionally-Robust Uncertainty Quantification.....	337
<i>Avinash Subramanian, Adam Gerlach, Alexander Von Moll, Flemming Holtorf, Benjamin Chung, Aayush Sabharwal, Jadon Clugston, Joshua Day, Christopher V. Rackauckas</i>	
Uncertainty Quantification of Machine Learning Models With Adaptive Sampling Applications	346
<i>Arjun Shah, Juan Alonso</i>	
A Multi-Fidelity Approach to Distribution Estimation Applied to Aerospace Applications.....	366
<i>Thomas Dixon, Geoffrey Bomarito, Gianluca Geraci, James Warner, Joshua Pribe, Michael Eldred, Alex Gorodetsky</i>	
Improving the Efficiency of Multi-Fidelity Approaches for Transfer Learning With Application to Hall Thrusters	383
<i>Wentz Jacqueline, Thomas A. Marks, Gianluca Geraci, Owen Davis, Michael Eldred, Alex Gorodetsky</i>	
An Efficient Parametric Reduced Basis Method to Emulate Fluid Flow with Shocks.....	403
<i>Muhammad Bilal, Kumaraguru Sethunarayanan, Ashwin Renganathan</i>	
Probabilistic Fatigue Crack Growth Analysis With Mixed Uncertainty on Equivalent Initial Damage Size.....	423
<i>Laura Hunt, Erin C. DeCarlo, Marcus Stanfield</i>	

Author Index