



2023 AFOSR Computational Math Annual Review

Dr. Fariba Fahroo | August 7-11, 2023 | Arlington, VA -hybrid

Agenda Day 1 | Monday- August 7, 2023

All times are EDT

Time	Topic	Speaker
8:00-8:20	Zoom Login	
8:20-8:30	Welcome – Opening Remarks	Dr. Fariba Fahroo, AFOSR
8:30	(YIP) Bayesian Learning of Dynamical Systems Under Uncertainty	Alex Gorodetsky (University of Michigan)
8:55	(YIP) Neural Fields: A Unifying Framework for Operator Learning	Paris Perdikaris, Jacob Seidman (University of Pennsylvania)
9:20	(YIP) Adaptive, Data-Driven Model Reduction for Shock-Dominated Flows to Enable Many-Query Computational Physics	Matt Zahr (University of Notre Dame)
9:45	MURI- Prediction, Statistical Quantification and Mitigation of Extreme Events Caused by Exogenous Causes or Intrinsic Instabilities (Virtual)	Themis Sapsis (MIT)
10:30	BREAK	
10:40	(YIP) Active Data Acquisition for Decision Making with Context-Aware Learning from Little Data	Benjamin Peherstorfer (Courant Institute, NYU)
11:05	Invariant-Domain Preserving IMEX Methods for Nonlinear Conservation Equations	Jean-Luc Guermond, Bojan Popov (TAMU)
11:30	Scale-Bridging Generalized Finite Element Methods for Structural Dynamics and Wave Propagation (Virtual)	C. Armando Duarte
11:55	Technology Transfer and Transition (T3) Capabilities	Sunny Shahhaidar-VT-ARC
12:05	LUNCH	
13:10	Low-Rank Multi-Fidelity Algorithms, Model Selection, and Budget Allocation	Akil Narayan (University of Utah) Alireza Doostan (UC Boulder)
13:50	Additive Runge–Kutta Methods for Mixed Model Simulations	Sigal Gottlieb (U Mass, Dartmouth)
14:15	Data-Rich Multi-Fidelity Methods for Aerospace Vehicle Design	Dan Clark, Ed Forster, Phil Beran, Chris Schrock (AFRL/RQVC)
14:40	Role of Matrix Plastic Deformation on Damage Evolution (Virtual)	Oana Cazacu -UFL

15:05	BREAK	
15:15	COE RQR Review	Karthik Duraisamy (University of Michigan)
16:15	Discussions on Generative AI	Led by Karthik Duraisamy
17:00	MEETING ADJOURN FOR THE DAY	

Agenda Day 2 Tuesday- August 8, 2023 All times are EDT		
Time	Topic	Speaker
8:00-8:20	Zoom Login	
8:20-8:30	Intro & Welcome	Fariba Fahroo
8:30	Adaptivity For Non-Uniform Meshes Utilizing SIAC-MRA	Jennifer Ryan (KTH Royal Institute of Technology)
8:55	A Bayesian Machine-Learning Perspective on the Quantum Many-Body Problem (Virtual)	George Booth (King's College)
9:20	Information Metrics and Stochastic Optimization Methods for Robust and Trustworthy Statistical Learning	Markos Katsoulakis, Luc Rey-Bellet (U Mass- Amherst), Paul Dupuis (Brown University)
10:00	(YIP'23) Data-Driven Reduced-Order Modeling for Turbulent Combustion Model Development	Cheng Huang (University of Kansas)
10:20	BREAK	
10:30	(YIP) MetaNO: A Meta-Learnt Neural Operator Framework	Yue Yu (Lehigh University)
10:55	Damage Detection with Spectral Representations (Virtual)	Amanda Criner (AFRL/RXCA)
11:20	AFRL/RX COE Review	Megna Shah (AFRL/RXNMD)
11:50	LUNCH	
13:00	Program Status Update	Fariba Fahroo (AFOSR)
13:25	OMT Based Particle Filtering (Virtual)	A. Tannenbaum (Stony Brook University), Tryphon Georgiou (UC Irvine)
14:05	Multi-Scale Approaches for Physics Understanding and Model Development of Turbulent Combustion	Ramakanth Muniapalli (AFRL/RQRC)

14:30	(YIP'23) Positivity-Preserving Entropy-Based Adaptive Filtering for Discontinuous Spectral Element Methods	Freddie David Witherden (TAMU)
14:50	High Order Essentially Non-Oscillatory and Bound-Preserving Remapping Methods (Virtual)	Chi-Wang Shu (Brown University)
15:15	BREAK	
15:25	MURI: Machine Learning for Physics-based Systems: Optimal Approximations, Architectures, and Training	Karen Willcox, Omar Ghattas (UT Austin), Hayden Schaeffer (UCLA)
16:25	Discussions on Data Assimilation and Inverse Problems	Led by Omar Ghattas
17:00	MEETING ADJOURN FOR THE DAY	

Agenda Day 3 Wednesday - August 9, 2023 All times are EDT		
Time	Topic	Speaker
8:00-8:20	Zoom Login	
8:20-8:30	Intro & Welcome	Fariba Fahroo
8:30	Low rank tensor methods for high dimensional PDEs	Jingmei Qiu (U. Delaware)
8:55	Collisional Particle-In-Cell Method for the Vlasov-Maxwell-Landau System	Jingwei Hu (University of Washington)
9:20	Versatile Mathematical Tools for Directed Energy Simulations	Leszek Demkowicz (UT Austin) Jay Gopalakrishnan (Portland State University)
10:00	Koopman Operator Theoretic Methods for Efficient Training and Analysis of Deep Neural Networks	Maria Fonoberova (AIMDyn Inc.)
10:25	BREAK	
10:35	Data Driven Modeling of Unknown Partial Differential Equations	Dongbin Xiu (Ohio State University)
11:00	Multiscale Stochastic Modeling, Conditioning, and Simulation of Rare Events	Roger Ghanem (USC)
11:40	LUNCH	

12:40	Rare Events: Analysis, Computation, and Robustness	Jose Blanchet (Stanford University), Youssef Marzouk (MIT)
13:40	Integration of High-Dimensional PDEs on Tensor Manifolds	Daniele Venturi (UC Santa Cruz)
14:05	BREAK	
14:15	Towards Large-Scale Quantum Accuracy Materials Simulations	Vikram Gavini (U. Michigan)
14:40	From Many-Body Quantum Systems to Classical Turbulence: Novel Horizons of Tensor Networks	Peyman Givi (U. Pittsburgh)
15:05	Adaptive Sparse Sampling for Scalable Rank-Adaptive Reduced-Order Modeling of Nonlinear Matrix Differential Equations with Time-Dependent Bases	Hessam Babaee (U. Pittsburgh)
15:30	MURI: Revolutionary Advances in Correlated Electron Materials: From Strongly Correlated Electrons to Large Scale DFT and Quantum Embedding	Garnet Chan (Caltech), Carlos Garcia-Cervera (UCSB)
16:30	Discussions on Quantum Algorithms for CFD	Led by Peyman Givi
17:00	MEETING ADJOURN FOR THE DAY	

Agenda Day 4 Thursday - August 10, 2023 All times are EDT		
Time	Topic	Speaker
8:00-8:20	Zoom Login	
8:20-8:30	Intro & Welcome	Fariba Fahroo
8:30	Machine Learning to Improve Turbulence Modeling (Open only to current PIs)	Chris Schrock (AFRL/RQ)
8:55	Optimization Under Uncertainty - A Generalized Koopman Expectation Framework	Adam Gerlach (AFRL/RQQA)
9:20	New Shockwave Science and Control Theory of Human-Machine-AI/GPT Dynamical Systems	Neil Johnson (GWU)
9:45	Embedded Boundary Methods with Stability, Accuracy, and Smoothness Guarantees for Multidisciplinary Design, Analysis and Optimization	Charbel Farhat (Stanford University)
10:10	BREAK	

10:20	Inference of Multi-Physics Forcing Functions with Confidence Intervals	Guus Jacobs (SD State University)
10:45	Mesh Generation and AI-Enhanced Algorithms for Modeling Complex Materials Systems	Soheil Soghrati (Ohio State University)
11:10	Feature Informed Data Assimilation	Daniel Tartakovsky (Stanford University)
11:35	LUNCH	
12:45	Compression-based Adaptive Hybrid Kinetic Method for Spacecraft Plasma Simulations	Samuel Araki, David Bilyeu (AFRL/RQRS)
13:10	A Machine Learning Framework for High-Dimensional Mean Field Games and Optimal Control	Lars Ruthotto (Emory)
13:35	MURI: Learning and Meta-Learning of Partial Differential Equations via Physics-Informed Neural Networks: Theory, Algorithms, and Applications	George Karniadakis (Brown University)
14:35	MURI: Innovations in Mean-Field Game Theory for Scalable Computation and Diverse Applications	Stan Osher (UCLA)
15:35	BREAK	
15:45	The CHORUS++ code for solar convection and dynamo	Chunlei Liang (Clarkson University)
16:10	(YIP'23): Transport Information Geometric Computations	Wuchen Li (University of South Carolina)
16:30	Discussions –Optimal Mass Transport	
17:00	MEETING ADJOURN FOR THE DAY	

Agenda Day 5 Friday, August 11, 2023 All times are EDT		
Time	Topic	Speaker
8:00-8:20	Zoom Login	
8:20	Intro & Welcome	Fariba Fahroo
8:30	Collocation methods for PDEs with integral fractional Laplacian	Zhongqiang Zhang (WPI)
8:55	Roles of Information Criteria for Model Calibration, Validation, and Surrogate Construction (Virtual)	Ralph Smith (NCSU)

9:20	Confidence intervals with frequentist guarantees: Disproving the Rust-Burrus Conjecture	Pau Battle Franch (Caltech)
9:40	MURI: A Robust Multi-Physics Design Analysis and Optimization Framework for Hypersonic Systems Grounded in Rigorous Model Reduction	Charbel Farhat (Stanford University)
10:40	MURI: The Science of Learning from Observations: Leveraging Scientific Computation with Intrinsic Machine Learning Models and Lifelong Learning	Mauro Maggioni (Johns Hopkins)
11:40	Discussions and Concluding Remarks	
12:30	MEETING ADJOURN	