



2024 AFOSR Computational Math Program Review

Dr. Fariba Fahroo | August 12-16, 2024 | Arlington, VA -hybrid

Agenda Day 1 Monday- August 12, 2024 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) Adaptive, Data-Driven Model Reduction for Shock-Dominated Flows to Enable Many-Query Computational Physics	Matt Zahr (University of Notre Dame)
8:55	(YIP'23) Data-Driven Reduced-Order Modeling for Turbulent Combustion Model Development	Cheng Huang (University of Kansas)
9:20	(YIP'24) Ambiguity-aware Artificial Intelligence via Statistical Inference	Edgar Dorbiban (U Penn)
9:40	MURI- Prediction, Statistical Quantification and Mitigation of Extreme Events Caused by Exogenous Causes or Intrinsic Instabilities (Virtual)	Themis Sapsis (MIT)
10:40	BREAK	
10:55	(YIP'24) Structure-Preserving (Scientific) Machine Learning: Theory and Application	Wei Zhu (Georgia Tech)
11:15	(YIP) Active Data Acquisition for Decision Making with Context-Aware Learning from Little Data	Benjamin Peherstorfer (Courant Institute, NYU)
11:40	DeepONet for Fast Data Assimilation in Transitional High-Speed Flows	Tamer Zaki (JHU)
12:05	GPT-PINN and TGPT-PINN: Linear and Nonlinear Model Order Reduction Toward Efficient Non-Intrusive Meta-Learning of Parametric PDEs	Sigal Gottlieb, Yanlai Chen (U Mass, Dartmouth)
12:30	LUNCH	
13:40	New Frontiers in Greedy Approaches for Linear and Nonlinear Model Reduction	Akil Narayan (University of Utah)
14:05	Spectral Correctness of the Approximation of the First-Order Form of Maxwell's Equations	Jean-Luc Guermond, Bojan Popov (TAMU)
14:30	Data-Rich Multi-Fidelity Methods for Aerospace Vehicle Design	Phil Beran, Chris Schrock (AFRL/RQVC)

14:55	Multi-scale Invariant Models Leading to New Understanding of Ductile Damage	Oana Cazacu (University of Arizona)
15:20	BREAK	
15:35	COE RQR Review-- Multi-fidelity Modeling of Rocket Combustor Dynamics	Karthik Duraisamy (University of Michigan)
16:15	Discussions on Foundation Models	Led by Karthik Duraisamy
17:00	MEETING ADJOURN FOR THE DAY	

Agenda Day 2 Tuesday- August 13, 2024		
All times are EDT		
Time	Topic	Speaker
8:00-8:20	Zoom Login	
8:20-8:30	Intro & Welcome	Fariba Fahroo, (AFOSR)
8:30	Interpolating Many-Electron Wave Functions Through Chemical Space (Virtual)	George Booth (King's College)
8:55	Information Geometric Regularization of the Barotropic Euler Equation	Florian Schafer (Georgia Tech)
9:20	(YIP) Nonlocal Attention Operator: Towards an Interpretable Foundation Model	Yue Yu (Lehigh University)
9:45	(YIP'23) Enhanced Entropy Filtering and Online Bayesian Optimization of Polynomial-Multigrid Cycles for High-Order Methods	Freddie David Witherden (TAMU)
10:05	BREAK	
10:20	Universal Approximation of Dynamical Systems by Semi-Autonomous Neural ODEs and Applications (Virtual)	Enrique Zuazua (Friedrich-Alexander-Universität Erlangen-Nürnberg) (FAU)
10:40	(MURI) Rare Events: Analysis, Computation, and Robustness	Jose Blanchet, Wei Cai (Stanford University)
11:40	Schrödinger's Control and Estimation Paradigm with Spatio-Temporal Distributions	Tryphon Georgiou (UC Irvine)
12:05	LUNCH	
13:15	Program Status Update	Fariba Fahroo (AFOSR)
13:40	Optimal Control of Conditional Processes: Old and New	Rene Carmona (Princeton University)

14:05	Foundations of Geometric Deep Learning	Amin Saberi (Stanford University)
14:30	Multi-Scale Approaches for Physics Understanding and Model Development of Turbulent Combustion	Matt Harvazinski, Ramakanth Munipalli (AFRL/RQRC)
14:55	A Scientific Foundation Model for PDEs: Multi-Operator Learning and Extrapolation (Virtual)	Hayden Schafer (UCLA)
15:20	BREAK	
15:35	Digital Twin MURI	Daniel Tartakovsky (Stanford)
16:00	Discussions on Digital Twins - Real Time Bayesian Inference and Prediction for High Fidelity Digital Twins Governed by Linear Time Invariant Dynamical Systems	Led by Omar Ghattas (UT Austin)
17:00	MEETING ADJOURN FOR THE DAY	

Agenda Day 3 Wednesday - August 14, 2024 All times are EDT		
Time	Topic	Speaker
8:00-8:20	Zoom Login	
8:20-8:30	Intro & Welcome	Fariba Fahroo (AFOSR)
8:30	A Semi-Lagrangian Adaptive-Rank Method (SLAR) for Linear Transport and Nonlinear Vlasov-Poisson Systems	Jingmei Qiu (U. Delaware)
8:55	Structure-Preserving Particle Method for the Landau Equation Modeling Plasma Collisions – Some Extensions	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	
10:40	Modeling Unknown Stochastic Systems via Generative Models	Dongbin Xiu (Ohio State University)
11:05	Tensor Networks: Structure learning, Uncertainty Quantification, and PDE Solutions	Alex Gorodetsky (University of Michigan)

11:30	LUNCH	
12:45	Information Metrics and Stochastic Optimization Methods for Robust and Trustworthy Statistical Learning	Markos Katsoulakis, Luc Rey-Bellet (U Mass- Amherst), Paul Dupuis (Brown University)
13:25	Towards Large-Scale Quantum Accuracy Materials Simulations	Vikram Gavini (U. Michigan)
13:50	Bi-fidelity Optimization and Failure Probability Estimation	Alireza Doostan (University of Colorado – Boulder)
14:15	MURI '24 --Tensor Network	Jingmei Qiu (U. Delaware)
14:35	BREAK	
14:50	Multiscale Stochastic Modeling, Conditioning, and Simulation of Rare Events	Roger Ghanem (USC)
15:15	From Many-Body Quantum Systems to Classical Turbulence: Novel Horizons of Tensor Networks	Peyman Givi, Juan Jose Mendoza-Arenas (U. Pittsburgh)
15:40	Adaptive Sparse Sampling for Scalable Rank-Adaptive Reduced-Order Modeling of Nonlinear Matrix Differential Equations with Time-Dependent Bases	Hessam Babae (U. Pittsburgh)
16:05	MURI: Revolutionary Advances in Correlated Electron Materials: From Strongly Correlated Electrons to Large Scale DFT and Quantum Embedding (Virtual)	Garnet Chan (Caltech), Carlos J. Garcia Cervera (UCSB)
16:35	Discussions	
17:00	MEETING ADJOURN FOR THE DAY	

Agenda Day 4 Thursday - August 15, 2024		
All times are EDT		
Time	Topic	Speaker
8:00-8:20	Zoom Login	
8:20-8:30	Intro & Welcome	Fariba Fahroo (AFOSR)
8:30	Machine Learned Turbulence Modeling	Chris Schrock (AFRL/RQ)
8:55	Rigorous Optimal Uncertainty Quantification & Optimization	Adam Gerlach (AFRL/RQQA)

9:20	New Shock Mathematics: Humans, Machinery and AI	Neil Johnson (GWU)
9:45	MURI: Learning and Meta-Learning of Partial Differential Equations via Physics-Informed Neural Networks: Theory, Algorithms, and Applications	George Karniadakis (Brown University) Mike Kirby (University of Utah)
10:45	BREAK	
11:00	Inference of Forcing Kernels in Generalized, Multi-Physics, Dynamic Systems	Guus Jacobs (SD State University)
11:25	Mesh Generation and AI-Enhanced Algorithms for Modeling Complex Materials Systems	Soheil Soghrati (Ohio State University)
11:50	A Machine Learning Framework for High-Dimensional Mean Field Games and Optimal Control (Virtual)	Lars Ruthotto (Emory)
12:15	LUNCH	
13:30	MURI: Innovations in Mean-Field Game Theory for Scalable Computation and Diverse Applications	Stan Osher (UCLA)
14:30	(YIP'24) Inference-Oriented Model Reduction for Linear Bayesian Smoothing Problems	Elizabeth Qian (GA Tech)
14:50	Feature Informed Data Assimilation	Daniel Tartakovsky (Stanford University)
15:15	(YIP'23): Transport Information Geometric Computations	Wuchen Li (University of South Carolina)
15:40	SDDC Solutions of Kinematic Dynamo Problems	Chunlei Liang (Clarkson University)
16:05	BREAK	
16:15	Kernel Methods with Machine Learning and Adaptivity	Jonah Reeger (AFIT)
16:40	Developments for Design under Uncertainty of Transient Systems	Ed Forster (AFRL/RQ)
17:00	MEETING ADJOURN FOR THE DAY	

Agenda Day 5 Friday, August 16, 2024 All times are EDT		
Time	Topic	Speaker
8:00-8:20	Zoom Login	
8:20	Intro & Welcome	Fariba Fahroo (AFOSR)

8:30	Heterogeneous Data Fusion by Graph-based Stochastic Models to Achieve Combinatorial Generalization of New Insights into Powder-based Fabrication (Virtual)	Hui Wang (FAMU)
8:55	HBCU-led Center for Scientific Machine Learning for the Materials Sciences (Virtual)	Yunjiao Wang (Texas Southern University)
9:20	AFRL/RX COE Review	Megna Shah (AFRL/RXNMD)
9:50	AFRL/RX Lab Task	Megna Shah & Jeff Simons
10:10	MURI: A Robust Multi-Physics Design Analysis and Optimization Framework for Hypersonic Systems Grounded in Rigorous Model Reduction	Charbel Farhat (Stanford University)
11:10	MURI: The Science of Learning from Observations: Leveraging Scientific Computation with Intrinsic Machine Learning Models and Lifelong Learning	Mauro Maggioni (Johns Hopkins)
12:10	Concluding Remarks –Discussions	
13:00	MEETING ADJOURN	