

# 2023 AFOSR Dynamical Systems and Control Theory Review

Dr. Fred Leve | September 11-15, 2023 | Arlington, VA -hybrid

Basic Research Innovation Collaboration Center (BRICC)  
4100 N Fairfax Drive, Suite 450 | Arlington, VA 22203

## Agenda Day 1 | September 11, 2023

Time	Topic	Speaker
8:00-8:30	In-person check-in / Virtual log-in	
8:30-8:40	Status Update	Frederick Leve, AFOSR
8:40-9:10	Fluids on geometric rough paths	James Michael Leahy, Imperial College London
9:10-9:40	Formalizing an optimization problem for inferring the entropy production from observed statistics	Gili Bisker, Tel Aviv University
9:40-10:10	Optimal Control of a Notional Hypersonic Missile	Meir Pachter, AFIT
10:10-10:30	<b>BREAK</b>	
10:30-11:00	Stochastic Thermodynamics: From Dissipativity to Accumulativity and Energy Storage to Entropy Production	Wassim Haddad, GaTech
11:00-11:30	Stochastic Systems with non-Gaussian Noise	Tyrone Duncan and Bozenna Pasik-Duncan, KU
11:30-12:00	Population Games and Evolutionary Dynamics: Towards a More Realistic Theory	Nuno Martins, Umaryland
12:00-1:30	<b>LUNCH (Outside BRICC)</b>	
1:30-2:00	Ensemble PDE Control	Miroslav Krstic, UCSD
2:00-2:30	Two-phase Differential Games and Cooperative Engagements in the Beyond Visual Range Domain	Eloy Garcia, AFRL/RQ
2:30-3:00	Advances in Contraction Theory for Neural Networks and Convex Optimization	Francesco Bullo, UCSB
3:00-3:20	<b>BREAK</b>	
3:20-3:50	Collaborative Coalitions in Multi-Agent Systems	Jason Marden, UCSB
3:50-4:20	Utilizing control-oriented properties in learning	Vijay Gupta, Notre Dame
4:20-4:50	Persistence of Graphs: Time-dependence and Directionality	Firas Khasawneh and Elizabeth Munch, Michigan State U
4:50-5:00	<b>Review Adjourn</b>	

## Agenda Day 2 | September 12, 2023

Time	Topic	Speaker
<b>8:00-8:30</b>	<b>In-person check-in / Virtual log-in</b>	
<b>8:30-8:40</b>	Morning Welcome and Discussions	Frederick Leve, AFOSR
<b>8:40-9:10</b>	Critical Nash Values for Graphon Mean Field Games	Peter Caines, McGill U
<b>9:10-9:40</b>	Flow-dependent Lyapunov functions and contraction analysis	Eduardo Sontag, Northeastern U
<b>9:40-10:10</b>	Global Minimization of Analytic Functions through Polynomial Approximations	Georgy Scholten, U Sorbonne
<b>10:10-10:30</b>	<b>BREAK</b>	
<b>10:30-11:00</b>	Boundary Arc and Boundary Point Stabilization of the Heat Equation on the Unit Disk via LQR	Art Krener, UC Davis
<b>11:00-11:30</b>	Direct Adaptive Control of Nonlinear Systems with Uncertain Unstable Zero Dynamics	Dennis Bernstein, Umich
<b>11:30-12:00</b>	Learning of Dynamical Systems with More Corrupt Data than Clean Data using Nonlinear Optimization	Javad Lavaei, UC Berkeley
<b>12:00-1:30</b>	<b>LUNCH (Outside BRICC)</b>	
<b>1:30-2:00</b>	Learning-Based Planning & Control with Persistent Safety for UA	Naira Hovakimyan, UIUC
<b>2:00-2:30</b>	Developments in Suboptimal Model Predictive and Constrained Control	Ilya Kolmanovsky, U Mich
<b>2:30-3:00</b>	An Interaction-aware, Monotone Systems approach to Reachability of Neural Feedback Loops	Sam Coogan, GaTech
<b>3:00-3:20</b>	<b>BREAK</b>	
<b>3:20-3:50</b>	Stat-duality based method for Rapid Solution of High-dimensional First-order HJ PDE Problems with Low-dimensional Nonlinearities	William McEneaney, UCSD
<b>3:50-4:20</b>	New Results on Convergent Spectral Decomposition of Dynamic Systems	Rushi Kamalapurkar, USF and Joel Rosenfeld, Uoklahoma
<b>4:20-4:50</b>	Operator Decompositions for Inverse Problems	Joel Rosenfeld, USF
<b>4:50-5:00</b>	<b>Review Adjourn</b>	

### Agenda Day 3 | September 13, 2023

Time	Topic	Speaker
<b>8:00-8:30</b>	<b>In-person check-in / Virtual log-in</b>	
<b>8:30-8:40</b>	Morning Welcome and Discussions	Frederick Leve, AFOSR
<b>8:40-9:10</b>	Duality theory for nonlinear filtering	Prashant Mehta, UIUC
<b>9:10-9:40</b>	Model-Based Machine Learning Methods for Optimal Feedback Control	Qi Gong, UCSC
<b>9:40-10:10</b>	Simultaneous perception-action design for minimum sensing navigation	Tanaka Takashi, UT Austin
<b>10:10-10:30</b>	<b>BREAK</b>	
<b>10:30-11:00</b>	Convexification of Motion Planning and Control through Liftings and Hypercomplex Numbers	Behcet Acikmese, U of Washington
<b>11:00-11:30</b>	Design of robust and accurate biosensing systems	Domitilla Del Vecchio, MIT
<b>11:30-12:00</b>	Dynamic Operads	David Spivak, Topos Institute
<b>12:00-1:30</b>	<b>LUNCH (Outside BRICC)</b>	
<b>1:30-2:00</b>	Functional and Distributional Control of Ensemble Systems using Moment Kernel Machines	Jrshin Li, Wash U
<b>2:00-2:30</b>	Distinguished Sets of Lie algebras and Their Applications	Xudong Chen, CU Boulder
<b>2:30-3:00</b>	Optimal Transport with Sign-indefinite Structure: A nonlinear Sinkhorn algorithm & its application to gene networks	Allen Tannenbaum, Stonybrook U
<b>3:00-3:20</b>	<b>BREAK</b>	
<b>3:20-3:50</b>	Distributed asynchronous non-convex optimization: Fundamental limits of convergence rates	Matthew Hale, UF
<b>3:50-4:20</b>	Resilience and guaranteed task completion for partially unknown nonlinear control systems	Melkior Ornik, UIUC
<b>4:20-4:50</b>	Dynamical Theory on Efficacy of Reservoir Computing	Adrian Wong, AFRL/RQ
<b>4:50-5:00</b>	<b>Review Adjourn</b>	

## Agenda Day 4 | September 14, 2023

Time	Topic	Speaker
<b>8:00-8:30</b>	<b>In-person check-in / Virtual log-in</b>	
<b>8:30-8:40</b>	Morning Welcome and Discussions	Frederick Leve, AFOSR
<b>8:40-9:10</b>	Topology in Optimization, Global Stabilization and System Equivalence	Mohamed Belabbas, UIUC
<b>9:10-9:40</b>	Data-guided Learning and Control of Higher Order Structures	Indika Rajapakse et al, U Mich and UTRC
<b>9:40-10:00</b>	<b>BREAK</b>	
<b>10:00-10:30</b>	Effective Whitney Stratification of Real Algebraic Varieties	Martin Helmer, NCSU and Vedit Nanda, Oxford
<b>10:30-11:00</b>	Mathematically Justified Computational Platform for Nonlinear Dynamics	Konstantin Mishaikow, Rutgers and William Kalies, Utoledo
<b>11:00-1:00</b>	<b>LUNCH (Outside BRICC) End of Regular Review</b>	
<b>Beginning of Open Hybrid Dynamical Systems</b>		
<b>1:00-1:30</b>	Uncertainty-Aware Guidance for Target Tracking subject to Intermittent Measurements using Motion Model Learning	Zachary Bell, AFRL/RW
<b>1:30-2:00</b>	The Geometry of Hybrid Dynamical Systems: From Intrinsic Properties to Robust Hybrid Geometric Control	Richard Sanfelice, UCSC
<b>2:00-2:30</b>	Multi-channel Time Domains and Clustering Protocols for Large-scale Interconnections of Hybrid Systems	Andy Teel, UCSB
<b>2:30-3:00</b>	Averaging Tools for a Class of Stochastic Hybrid Dynamical Systems with Multi-Time Scale Flows	Jorge Poveda, UCSD
<b>3:00-3:20</b>	<b>BREAK</b>	
<b>3:20-3:50</b>	Probabilistic Invariance and Data-Driven Reachability for Gaussian Process State Space Models	Murat Arcak, UC Berkeley
<b>3:50-4:20</b>	Piecewise-deterministic Markov Processes: Abrupt Context changes and Structured Uncertainty	Alexander Vladimirovsky, Cornell
<b>4:20-4:50</b>	Topological Methods for Assured Transitions in Hybrid Systems	Warren Dixon and Dan Guralnik, UFL
<b>4:50-5:00</b>	<b>Review Adjourn</b>	

## Agenda Day 5 | September 15, 2023

### Second Day of Open Hybrid Dynamical Systems (MURI Teams)

Time	Topic	Speaker
<b>8:00-8:30</b>	<b>In-person check-in / Virtual log-in</b>	
<b>8:30-8:40</b>	Morning Welcome and Discussions	Frederick Leve, AFOSR
<b>8:40-9:10</b>	Hybrid Dynamics - Deconstruction and Aggregation: An Overview of the Project	Yuliy Barishnikov, UIUC
<b>9:10-9:40</b>	On Invariants, Composition, and Networks of Hybrid Systems	Paulo Tabuada, UCLA
<b>9:40-10:10</b>	Toward a Toolbox (and its Use) for Systems ID of Nonlinear Hybrid Dynamical Systems from Data	Dan Koditschek, Upenn
<b>10:10-10:30</b>	<b>BREAK</b>	
<b>10:30-11:00</b>	A Topological view of Design for Multi-Agent Hybrid Systems	Sayan Mitra, UIUC
<b>11:00-11:30</b>	A Categorical Perspective on Lyapunov	Aaron Ames, Caltech
<b>11:30-12:00</b>	Hybrid Dynamical Systems with Slow and Fast Time-variation and Mode Switching	Daniel Liberzon, UIUC
<b>12:00-1:30</b>	<b>LUNCH (Outside BRICC)</b>	
<b>Beginning of Open Hybrid Dynamical Systems</b>		
<b>1:30-2:00</b>	Unified Framework for Invariance and Composition of Open Hybrid Dynamical Systems	Taeyoung Lee, GWU
<b>2:00-2:30</b>	Geometry, Topology, and Symmetry of Open Smooth and Hybrid Systems	Anthony Bloch, U Mich and William Clark, Ohio University
<b>2:30-3:00</b>	Interaction Networks, Homological Dynamics, and Control	William Kalies, Univ of Toledo and Konstantin Mischaikow, Rutgers
<b>3:00-3:20</b>	<b>BREAK</b>	
<b>3:20-3:50</b>	Modeling, Control, and Trajectory Optimization by Exploiting Lie Group Symmetry	Maani Ghaffari, U Mich
<b>3:50-4:20</b>	Real-Time Verification of High-Dimensional Systems via Composition of Reachable Sets	Ram Vasudevan, U Mich
<b>4:20-4:50</b>	Compositional Reactive Planning for Complex Tasks using Topological Invariants of Strategy Spaces	Dan Guralnik, UFL
<b>4:50-5:00</b>	<b>Review Adjourn</b>	