Contribution ID: **19** Type: **Poster**

Structured sparse regression in quadratic manifolds

Monday 26 May 2025 17:10 (1h 50m)

Approximating field variables and data vectors from sparse samples is a key challenge for model order reduction of nonlinear dynamical systems. Without utilizing sparse samples – a process often referred to as hyper-reduction – the online costs of the reduced model continue to scale with the dimension of the full model. In this talk, we present a new methodology for empirical sparse regression that computes approximations as nonlinear projections onto precomputed quadratic manifolds. Empirical sparse regression on quadratic manifolds can reduce approximation errors by several orders of magnitude compared to widely used methods such as gappy proper orthogonal decomposition or discrete empirical interpolation, which rely on linear approximation spaces by several orders of magnitude. This advantage is particularly pronounced when the data represents transport-dominated or wave-like dynamics, as commonly observed in energy-conserving dynamical systems. After revisiting our greedy quadratic manifold construction, we detail the sparse regression algorithm and demonstrate its effectiveness through numerical examples, showcasing applications in Vlasov systems and a rotating detonation rocket engine.

Authors: SCHWERDTNER, Paul (NYU); GUGERCIN, Serkan; PEHERSTORFER, Benjamin (New York University)

Presenter: SCHWERDTNER, Paul (NYU)

Session Classification: Poster Blitz & Poster Section