# Computational and Data Enabled Science Seminar

## *Reduced order modelling as enabler for optimization and digital twins*

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**Abstract:** We present data-driven reduced order models with a focus on reduction in parameter space to fight the curse of dimensionality in design optimization. We show two extensions of the Active Subspaces (AS) technique: a kernel version exploiting an intermediate mapping to a higher dimensional space, and a local approach in which a clustering induced by a global active subspace is used for regression and classification tasks. Parameter space reduction methods can also be used within a multi-fidelity nonlinear autoregressive scheme to improve the approximation accuracy of high-dimensional functions, using only high-fidelity data. Finally, we integrate AS into the genetic algorithm to enhance the convergence during the optimization of high-dimensional quantities of interest. These methods, together with non-intrusive reduced order models based on proper orthogonal decomposition, are applied to the structural optimization of cruise ships and shape optimization of a combatant hull. The last part of the talk will be devoted to an ongoing work on digital twins and adaptive planning strategies in a Bayesian setting.

Thursday, September 8, 2022, 10:00 am

Mathematics and Science Center: MSC W301

# Mathematics

# Emory University