Data to Decisions: Computational Methods for the Next Generation of Aerospace Systems

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New technologies are changing the way we think about designing and operating aerospace systems. For example, in next-generation aircraft the combination of sensing technologies and computational power brings new opportunities for data-driven modeling and data-driven decision-making. Yet data alone cannot deliver the levels of predictive confidence and modeling reliability demanded for these systems. For that, we must build on the decades of progress in rigorous physics-based modeling and associated uncertainty quantification. This talk discusses our work at the intersection of physics-based and data-driven modeling, with a focus on the design of next-generation aircraft. We show how adaptive reduced models combined with data-driven learning enable dynamic decision-making onboard a structural-condition-aware UAV. We show how multifidelity formulations exploit a rich set of information sources to achieve multidisciplinary design under uncertainty for future aircraft concepts.