



**SMU | LYLE**

*Engineering Management, Information, and Systems*  
**Seminar Series**

**Research Seminar**

**Opportunities and Challenges of Black Box  
Optimization in Engineering Applications**



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**Friday, February 5, 2021**  
**11:00 a.m. – 12:15 p.m.**

**Zoom link: <https://smu.zoom.us/j/95095343594>**

**Abstract:** Systems across manufacturing, life science, verification, energy, have become increasingly complex. In particular, simulation has become a standard tool to evaluate the performance of such systems independently from the objective being optimization, control, or certification. As a result, black box optimization has started to attract increasing attention.

In this talk, we look into the broad family of Black Box Optimization methods, where the focus is on families of algorithms that deliberately inject randomness in the search process (whether or not the original dynamics is stochastic). We contextualize the methods with respect to several engineering applications with a focus on certification of cyber physical systems. We focus on three key challenges: (1) there is no homogeneous dynamics of the systems, (2) high dimensions need to be considered (and they all matter!), and (3) we can construct clever approximations of the system behavior and/or we can learn/exploit structural properties of the problem at hand. We show new algorithms that: (1) alternate local and global search to make use of local knowledge while exploring the space of possible solutions; (2) decompose the original problem and try to learn, from lower dimensional formulations, good guesses for the original problem; (3) use information coming from approximations or properties of the original problem to accelerate the black box approaches. Performance of the proposed approaches is reported and analyzed and key future directions are discussed.

**Biography:** Giulia Pedrielli is currently Assistant Professor for the School of Computing Informatics System Design Systems Engineering at Arizona State University. She graduated from the Department of Mechanical Engineering of Politecnico di Milano. She develops her research in stochastic methods for performance evaluation and simulation-based optimization of next generation cyber physical systems. She is focusing on real time control problems and how to extend simulation-based algorithms in this context, in applications related to individualized cancer care, bio-manufacturing, design and control of self-assembled RNA structures, and unmanned vehicles control verification.