



The T. J. Wilmott '80 Endowed Professor, Luis Nunes Vicente

Chair of the ISE Department

Lehigh University, PA

**Date:** Friday, Feb. 20, 2026

**Time:** 1 - 1:50 pm

**Location:** SW 101

### *Pareto sensitivity, most-changing sub-fronts, and knee solutions*

**Abstract:** When dealing with a multi-objective optimization problem, obtaining a comprehensive representation of the Pareto front can be computationally expensive. Furthermore, identifying the most representative Pareto solutions can be difficult and sometimes ambiguous. A popular selection are the so-called Pareto knee solutions, where a small improvement in any objective leads to a large deterioration in at least one other objective. In this paper, using Pareto sensitivity, we show how to compute Pareto knee solutions according to their verbal definition of least maximal change. We refer to the resulting approach as the sensitivity knee (snee) approach, and we apply it to unconstrained and constrained problems. Pareto sensitivity can also be used to compute the most-changing Pareto sub-fronts around a Pareto solution, where the points are distributed along directions of maximum change, which could be of interest in a decision-making process if one is willing to explore solutions around a current one. Our approach is still restricted to scalarized methods, in particular to the weighted-sum or epsilon-constrained methods, and require the computation or approximations of first- and second-order derivatives. We include numerical results from synthetic problems that illustrate the benefits of our approach. This is joint work with Tommaso Giovannelli and Marcos M. Raimundo.

**Biography:** Luis Nunes Vicente is the Timothy J. Wilmott '80 Endowed Faculty Professor and Chair of Lehigh University's Department of Industrial and Systems Engineering (ISE). His research interests include Continuous Optimization, Computational Science and Engineering, and Machine Learning and Data Science. He obtained his PhD from Rice University in 1996, under a Fulbright scholarship, receiving from Rice the Ralph Budd Thesis Award. He was one of the three finalists of the 94-96 A. W. Tucker Prize of the Mathematical Optimization Society (MOS). In 2015, he was awarded the Lagrange Prize of SIAM (Society for Industrial and Applied Mathematics) and MOS for the co-authorship of the book "Introduction to Derivative-Free Optimization, MPS-SIAM Series on Optimization, SIAM, Philadelphia, 2009". He is a SIAM Fellow (Class of 2024). He was elected chair of the SIAM Activity Group on Optimization for 2023-2025 and President of the Association of Chairs of Operations Research Departments (ACORD) at INFORMS for 2024-2025. He has been chairing Lehigh ISE since August 2018.