Complexity Science mini-project:
Efficient Global Optimization for Finding Robust Solutions

Background: Efficient Global Optimization (EGO) has recently been proposed as an optimisation technique for problems where evaluating the quality of a candidate solution is very expensive or time consuming. In a nutshell, the algorithm evaluates some solutions, and then estimates a response surface to "guess" which other solutions might be most promising. Such algorithms are often used for optimisation of engineering designs, where only a time-consuming simulation model is available to evaluate the quality of a solution. However, in many engineering design problems, it is important that the design not only performs well, but also that it is robust against manufacturing tolerances. One way to evaluate the robustness of a design would be to evaluate it multiple times, with different deviations applied. However, doing so for every design considered during the optimisation problem would be computationally prohibitive.

Mini-project: The goal of the mini-project would be to extend the EGO algorithm to be able to estimate the robustness of the solution directly, where robustness would be defined as expected performance given manufacturing tolerances.

PhD prospect: This topic falls under the general topic of simulation-based optimisation, with many avenues for future research. There is also a close collaboration with EnginSoft, an Italian company specializing on engineering optimisation software.

I have applied for a European Industrial Doctorate project on Simulation Optimisation. If this is successful, the student's PhD could be fully funded through this EU project.

Deliverables:

A variant of EGO that can be applied to search for robust solutions.

Student's requirements:

Experience with Matlab and/or Gaussian Process Networks would be beneficial. One of my PhD students is working with Gaussian Processes, so competent help is available.

References

[1] Jones, Schonlau, Welch: Efficient global optimization of expensive black-box function. Journal of Global Optimization 13(4), pp. 455-492, 1998