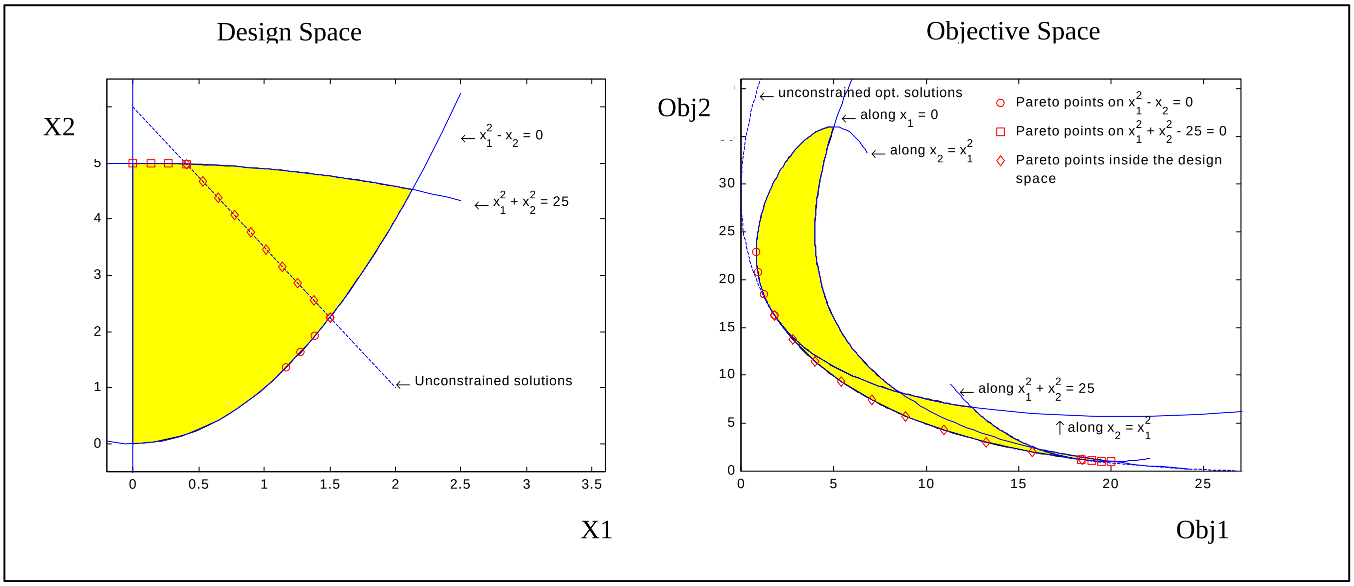
CLEMSON UNIVERSITY

CREDO LABORATORY PROJECTS

Project Title: APPROXIMATION OF THE PARETO SET IN MULTI-OBJECTIVE PROBLEMS



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Project Abstract:

In Multiple Criteria Optimization (MCO), the solution of the MCO problem is referred to as the Pareto set. Using Pareto solutions, the decision-maker can have an overview of the possible solutions achievable by the different articulations of his or her preferences. Calculating the whole Pareto set using current procedures (mostly through the use of Pareto Genetic Algorithms) is very expensive in terms of computational time. There are issues of distribution of points over the set, issues of preventing the GA from converging on a single solution, which is what the algorithm is designed to do, and issues of computational requirements.

For convex problems, using partial information from the Pareto set, an approximation of the Pareto set can be constructed. The Hyper-ellipse is an easy to tailor curve, which in our work, is used to approximate the convex bi-criteria optimization Pareto set. Using only two end points and one point in the middle of the Pareto curve, a portion of the hyper-ellipse curve can be used as an approximation of the Pareto solutions in the objective space. For convex bi-criteria optimization problems, unconstrained examples and constrained (linear and non-linear constraints) examples have been tested and the results are well within acceptable error bounds.

Future work will extend the approximations to multiple criteria optimization problems and to non-convex problems. Furthermore, if a desired solution is selected from the approximation curve or hyper-surface, reverse engineering the solution in the design space to obtain the values of the design variables from the values of criteria without redoing the optimization process is being investigated.

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