Integration of Matlab based search engines into iSIGHT and Model Center

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Rationale: Matlab/Optimisation/Matlab have become the vehicles for new DSO algorithm development in the Southampton UTP.

To be able to leverage these algorithms to BAE Systems business and reduce cost and complexity for incorporating in iSIGHT and Model Center (MC), we have used the Matlab/Optimisation plug-in facilities available in these tools. Matlab code can also be compiled into C/C++ code for efficiency and obviating the need for a Matlab license on the user system.

iSIGHT Plug-ins: Two sets of plug-ins have been developed for iSIGHT:

1. For single objective optimisation problems:
   a. A General plug-in that incorporates Optimisation methods directly into the iSIGHT set of optimisers
   b. A Matlab based plug-in that uses Optimisation/Matlab to run an optimiser and schedule trials via the Optimisation GUI.

2. For multi-objective optimisation problems:
   a. A Matlab based plug-in that uses the NSGA2 multi-objective algorithm to build a global Pareto-optimal front solution to the optimisation problem
   b. A Matlab based plug-in that uses the NSGA2 multi-objective algorithm to build a global Pareto-optimal front solution to the optimisation problem

Basic Options iSIGHT Plug-In GUI:

Run control parameters:
Maximum Iterations: 500
Optimisation mode: Minimum
Latest method selected: None
Optimisation DOE and RM methods available for selection (DOE, DOE, RM and optimisation algorithms).

Run schedule selected:
Build Model as Objective function.

Matlab based NSGA2/NSGA2 Plug-in:

Uses a modified form of the NSGA2 multi-objective algorithm to map out a global optimal Pareto front of the problem.

Matlab Plugin in script showing settings for NSGA2 algorithm parameters.

The NSGA2_RSM version runs any combination of objective function and/or constraints can be approximated (rather than evaluated directly) by the analysis code, using Optimisation technique (including various forms of linearisation).

Matlab based Options Plug-in:

The Options/Matlab Plug-in enables the optimisation tool to be called from a Matlab script running in the Model Center (MC) Matlab Plug-in component. The aim being essentially to provide computed code for all the Matlab scripts so that the Options/Matlab Plug-in can be run on code to Matlab form. This is achieved by using the Options/Matlab plug-in to run the NSGA2 multi-objective algorithm to build a global Pareto-optimal front solution to the optimisation problem using direct evaluation of the objective functions and constraints.

Options Method Selection (Scheduling) GUI:

Options Plug-In for Model Center:

Two sets of plug-ins have been developed for Model Center:

1. A single objective optimisation purposes:
   a. A GUI based plug-in that incorporates Optimisation methods directly into the Model Center set of optimisers
   b. A Matlab based plug-in that uses Optimisation/Matlab to run an optimiser and schedule trials via the Optimisation GUI

2. For multiple objective optimisation purposes:
   a. A Matlab based plug-in that uses the NSGA2 multi-objective algorithm to build a global Pareto-optimal front solution to the optimisation problem using direct evaluation of the objective functions and constraints
   b. A Matlab based plug-in that uses the NSGA2 multi-objective algorithm to build a global Pareto-optimal front solution to the optimisation problem

The OptionsNSGA2 Plug-in:

The OptionsNSGA2 Plug-in is a development of the OptionsNSGA2 algorithm, and is a combination of the multi-objective search algorithms NSGA2 and a collection of RSM techniques available in Options/Matlab by setting parameters that control the range of objective function and constraint response surface models can be built and then searched multi-objectively by the NSGA2 algorithm.

The OptionsNSGA2_RSM Plug-in:

The OptionsNSGA2_RSM algorithm is a development of the OptionsNSGA2 algorithm, and is a combination of the multi-objective search algorithms NSGA2 and a collection of RSM techniques available in Options/Matlab by setting parameters that control the range of objective function and constraint response surface models can be built and then searched multi-objectively by the NSGA2 algorithm.

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