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HS-4425: Multi-Objective Shape Optimization Study

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HS-4425: Multi-Objective Shape Optimization Study

Continuing from tutorial HS-4000: Optimization Method Comparison: Arm Model Shape Optimization, you will perform a multi-objective Optimization study.

In this tutorial, you will be searching for the Pareto front that minimizes both volume and maximum displacement. You will be using MOGA with a Fit to save time.

Note: If a Fit was not available, GRSM would be the suggested method to use in order to solve a MOO problem. MOO problems require many evaluations, therefore GRSM is more efficient than MOGA.

Before running this tutorial, complete tutorial Tutorial HS-4000: Optimization Method Comparison: Arm Model Shape Optimization. You can also import the archive file `HS-4000.hstx`, available in `<hst.zip>/HS-4425/`.

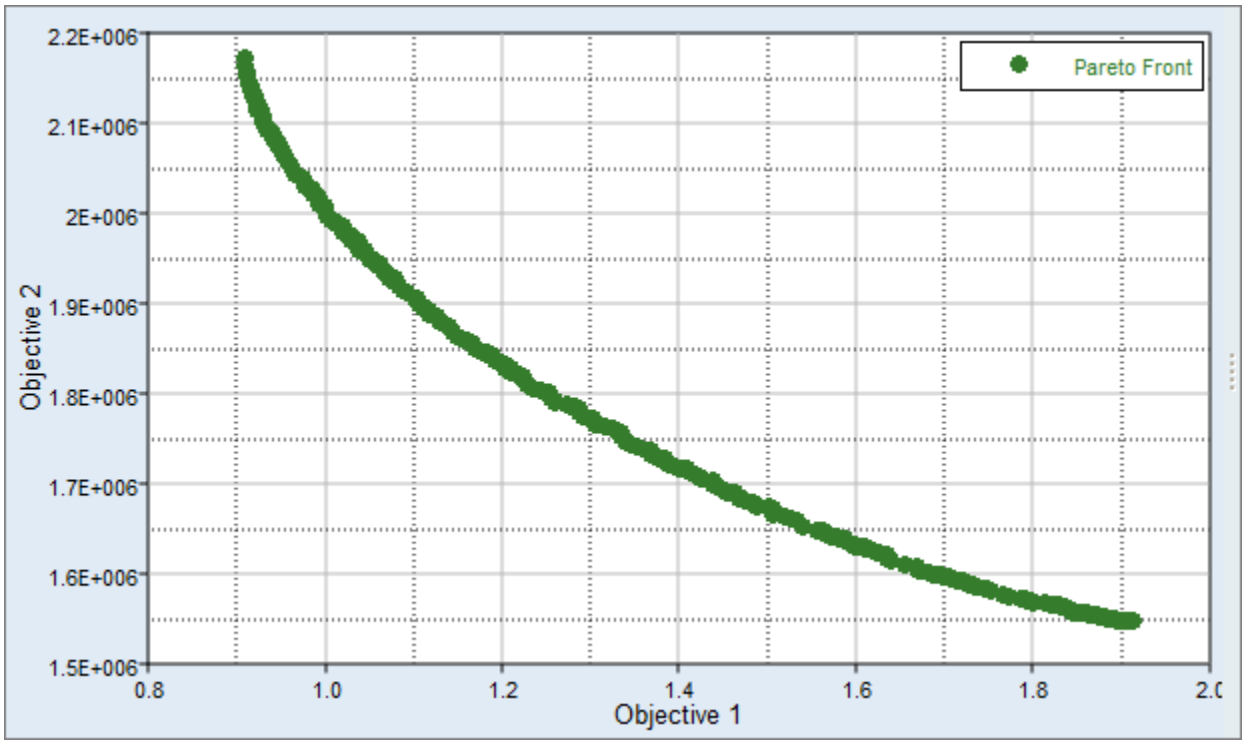
1. In the **Explorer**, right-click and select ***Add*** from the context menu.
2. In the **Add - HyperStudy** dialog, select ***Optimization*** and click ***OK***.
3. Go to the **Select Input Variables** step.
4. In the work area, **Active** column, clear the ***radius_1***, ***radius_2*** and ***radius_3*** check boxes.
5. Go to the **Select Output Responses** step.
6. Apply an objective on the Volume and Max_Disp output responses.
   a. In the **Objectives** column, click .
   b. In the pop-up window, set **Type** to ***Minimize*** and click ***OK***.
7. In the **Evaluate From** column for Max_Disp, Max_Stress, and Volume, select ***Fit, RBF (fit_4)***.

	Active	Label	Varname	Objectives	Constraints	Evaluate From	Expression	Comment
1	☑	Max_Disp	m_1_r_1	Minimize ...		Fit, RBF (fit_4)	max(m_1_ds_1)	Data Source 1 ...
2	☑	Max_Stress	m_1_r_2			Fit, RBF (fit_4)	max(m_1_ds_2)	Data Source 2 ...
3	☑	Volume	m_1_r_3	Minimize ...		Fit, RBF (fit_4)	m_1_ds_3[0]	Data Source 3 ...

8. Click ***Apply***.
9. Go to the **Specifications** step.
10. In the work area, set the **Mode** to ***Multi-Objective Genetic Algorithm (MOGA)***.
11. **Note**: Only the methods that are valid for the problem formulation are enabled.
12. Click ***Apply***.
13. Go to the **Evaluate** step.
14. Click ***Evaluate Tasks***. HyperStudy stops MOGA after 50 iterations, and performs a total of 13317 analyses. The Pareto front of the last iteration contains 408 points.
15. Go to the **Post-Processing** step.
16. Click the ***Optima*** tab.

    The Pareto front of Objective 2 versus Objective 1 is displayed in the plot.

The goal of this study was to minimize both Volume (Objective 1) and Max_Disp (Objective 2). The Pareto plot shows all of the non-dominated solutions. A non-dominated solution is a solution which can no longer improve one objective without deteriorating another. You can see that minimizing Objective 1 will increase Objective 2, and minimizing Objective 2 will increase Objective 1. According to these results, you must decide what would be the optimal solution. For instance, the Pareto plot may allow a compromise solution to be selected somewhere in the middle.



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