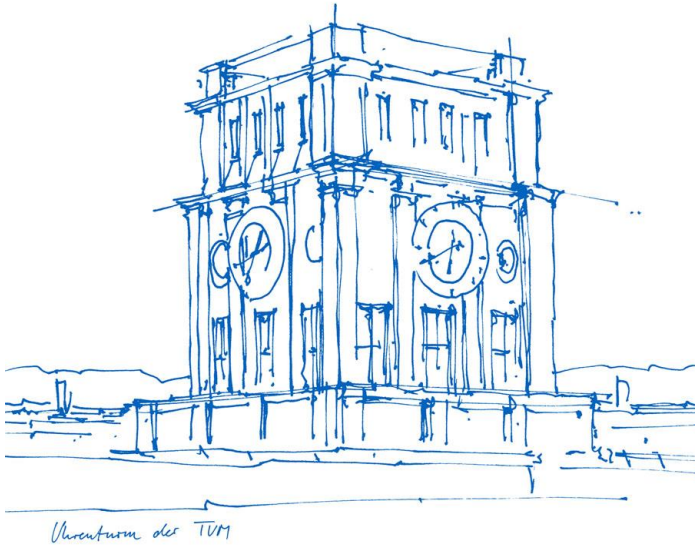
Laboratory for Product Development and Lightweight Design
Department of Mechanical Engineering
Technical University of Munich

How To: Xray Tool

Garching

October, 2020

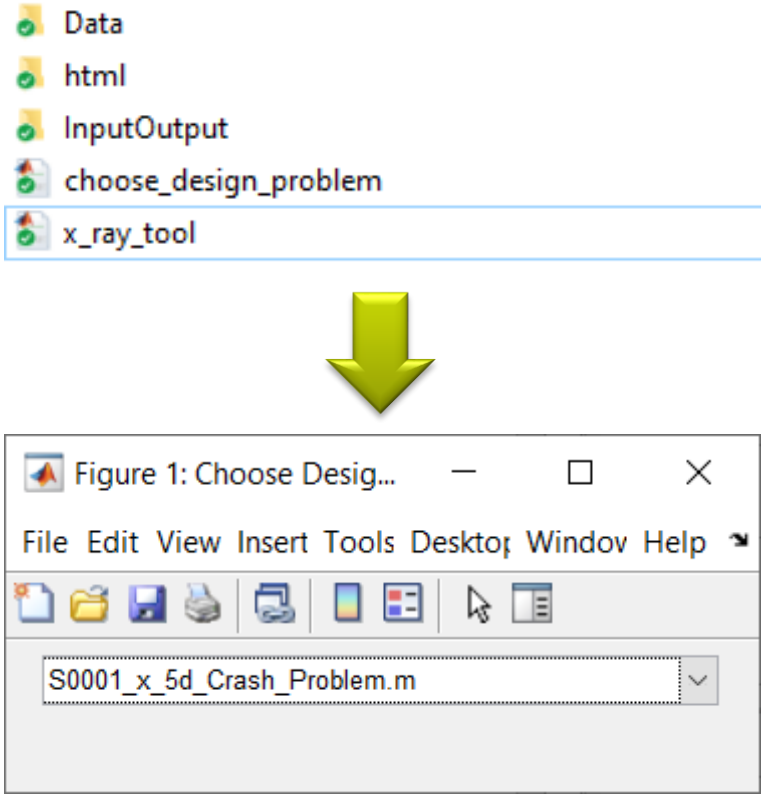
LPL



Opening the tool

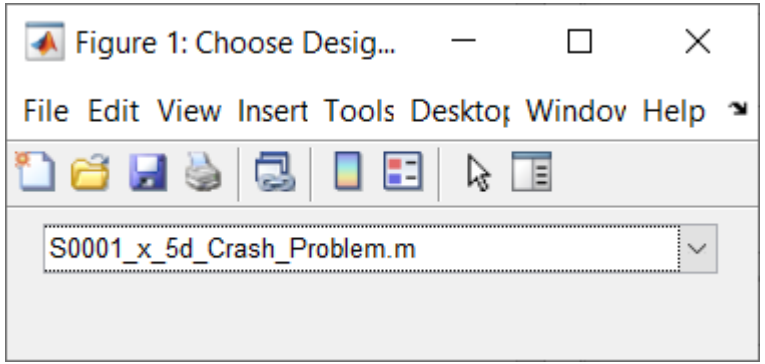
- Go to the actual version of the tool (version v11)
- Open the XRay folder and execute the function x_ray_tool.m with MATLAB.
- Note:
  - “Image Processing Toolbox” has to be installed
  - MATLAB version has to be R2018b or newer.

  If the requirements are not satisfied the executed function will report an error.
- By running the code a small drop-down window is going to open in the lower right corner of the screen. Where you can choose the design problem.



Choosing design problems

- The recent opened window consists of a dropdown menu containing all design problems which were set up.
- Choose the design problem by opening the drop-down list and clicking on the desired problem (always necessary, also if only one problem available).
- Note: Depending on the problem the execution may take some time, due to the necessary evaluation of the system response function. **Wait until the next windows open.**



User Interface Window

- The lower part of the appearing windows contains of the quantitative values of the design variables and quantities of interest. The window consists of the top row button group and a lower tab group. In the top row there are the buttons for updating the result window, to load parameters, an input filed to change the sample size and a button to save the progress. The tab group is divided into two tabs. One for the design variables and one for the quantities of interest.
- The DVs can be changed by changing their lower or upper value in the interactive boxes or by dragging the slider.
- The QOIs can be changed by changing their lower and upper bounds. Furthermore, certain QOIs can be set inactive and hence will no longer be calculated. By setting the visibility of a QOI to false, all the points generated with its color will no longer be shown in the result figure. This may help to identify regions of good design in an early stage of the process.
- Every change in the User Interface will lead the necessity of updating the Results. Therefore the update button changes its color from green to red whenever a change is done.

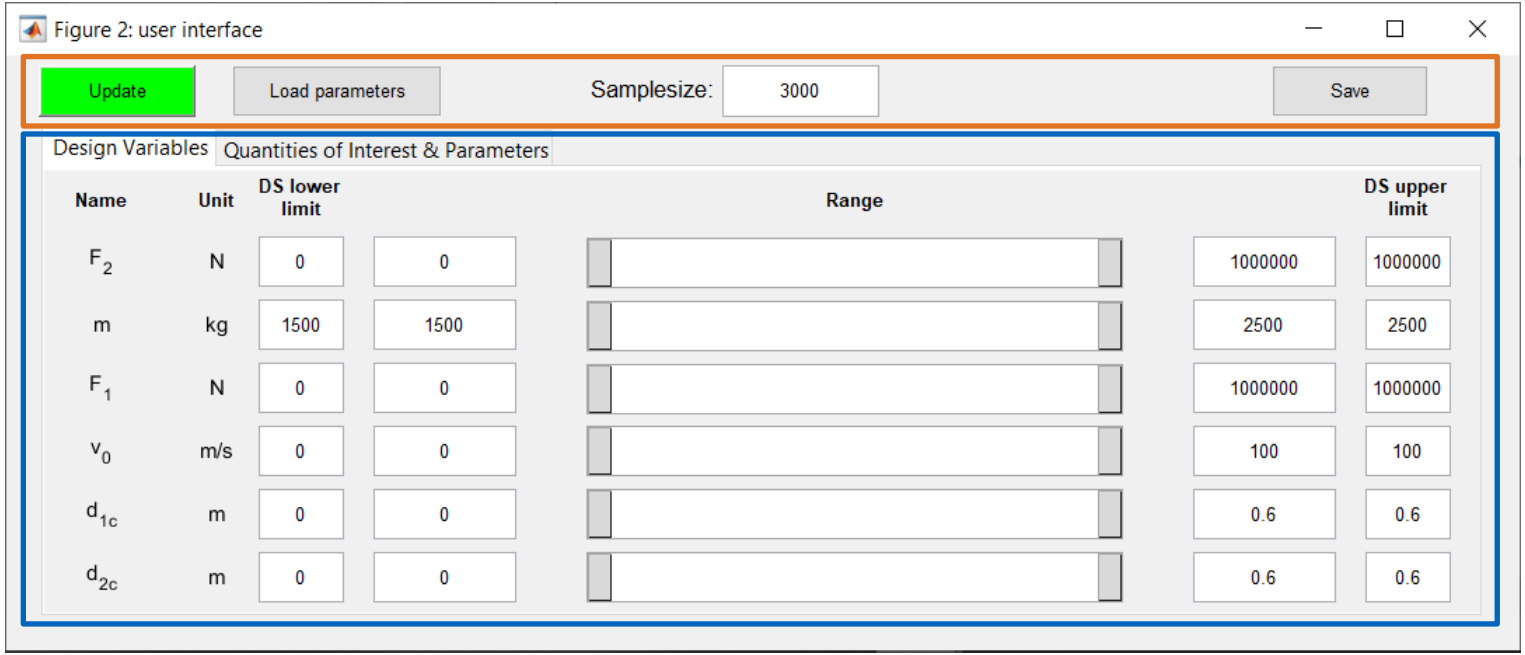


Figure 2: user interface
Update
Load parameters
Samplesize:
3000
Save
Design Variables
Quantities of Interest & Parameters
Name
Unit
DS lower limit
Range
DS upper limit
F2 N 0 0 1000000 1000000
m kg 1500 1500 2500 2500
F1 N 0 0 1000000 1000000
v0 m/s 0 0 100 100
d1c m 0 0 0.6 0.6
d2c m 0 0 0.6 0.6

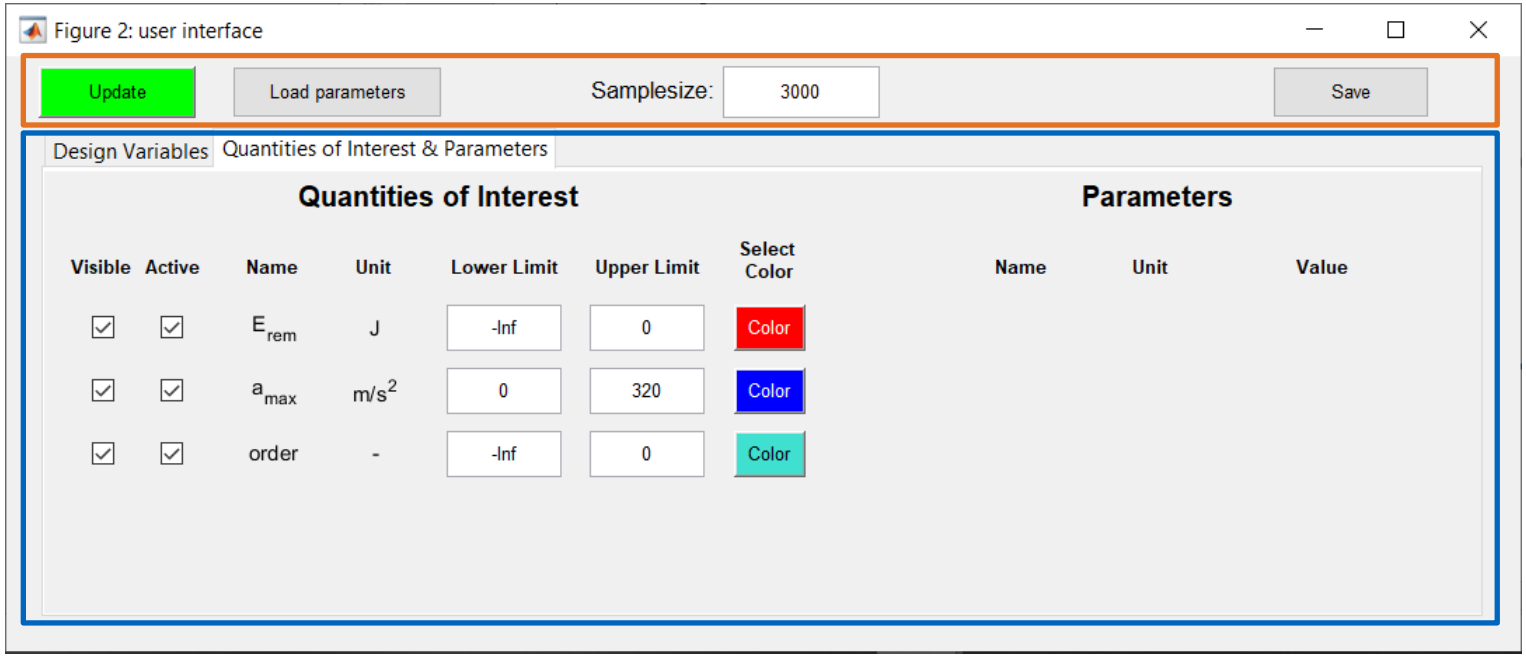


Figure 2: user interface
Update
Load parameters
Samplesize:
3000
Save
Design Variables
Quantities of Interest & Parameters
Quantities of Interest
Visible
Active
Name
Unit
Lower Limit
Upper Limit
Select Color
E_{rem}
J
-Inf
0
Color
a_{max}
m/s^2
0
320
Color
order
-
-Inf
0
Color
Parameters
Name
Unit
Value

Result Window

- The result window will contain the plots of the DVs. In the plots the user can identify regions of good designs. Green points represent good designs. A point in another color violates at least the QOI represented by this color but may violate others to. The black lines represent the limits of the rectangular solution spaces chosen by the designer. They can be dragged in the plots to extend or abbreviate an interval of a DV. Every change will, similar as in the User Interface, require an update of the results to see the changes. Therefore the changed line will turn red.
- If a user wants to change the DVs which are plotted in a certain plot one can click on the paintbrush icon when hovering the plot. A new window will open, where one can choose the DVs for the x and y axis from the list of existing DVs.
- By using the menu bar element “Manage Plots” one can add or remove plots. Adding a plot will require the specification of the DV of the axis. and deleting a plot will require the choice of the plot to be removed. Consequently in both cases a new window will open to insert the required specifications.

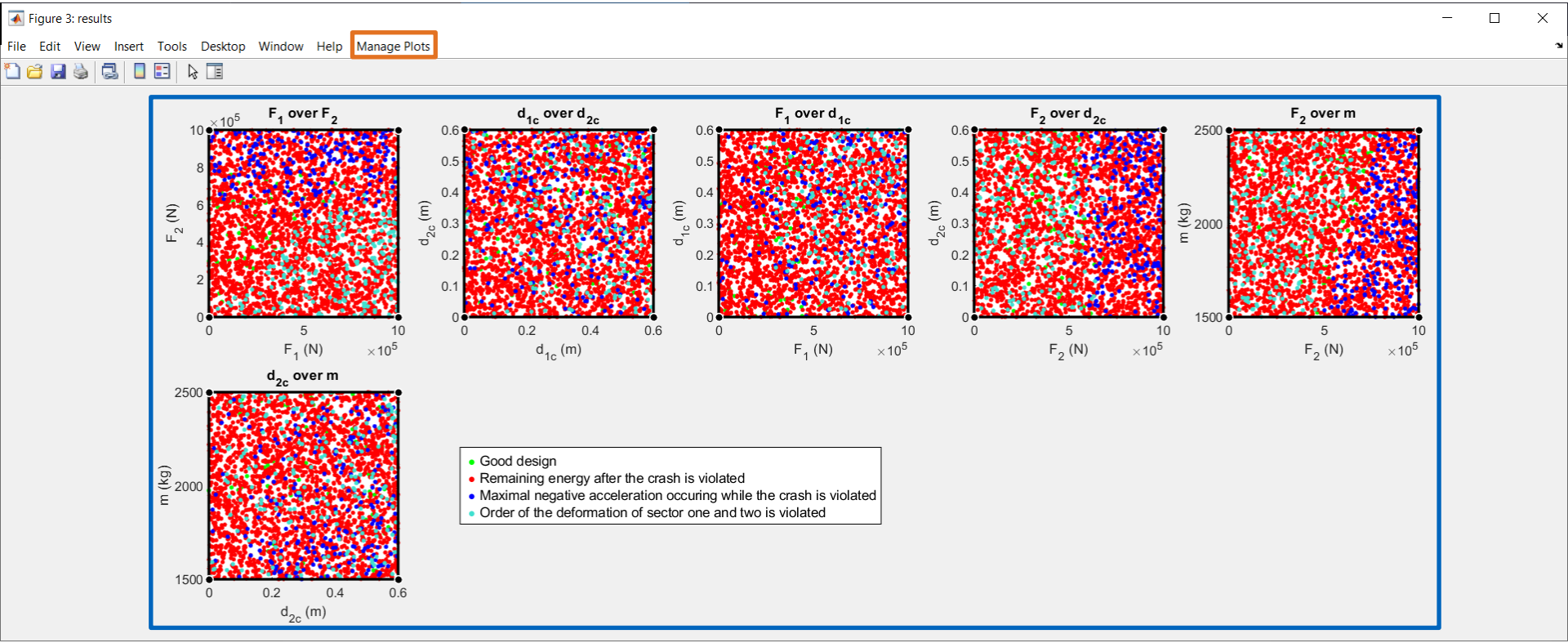


Figure 3: results
File Edit View Insert Tools Desktop Window Help Manage Plots
F1 over F2
F2 (N)
F1 (N)
×10^5
d1c over d2c
d2c (m)
d1c (m)
F1 over d1c
d1c (m)
F1 (N)
F2 over d2c
d2c (m)
F2 (N)
F2 over m
m (kg)
F2 (N)
d2c over m
m (kg)
d2c (m)
Good design
Remaining energy after the crash is violated
Maximal negative acceleration occuring while the crash is violated
Order of the deformation of sector one and two is violated