TopOpt 2D UserGuide
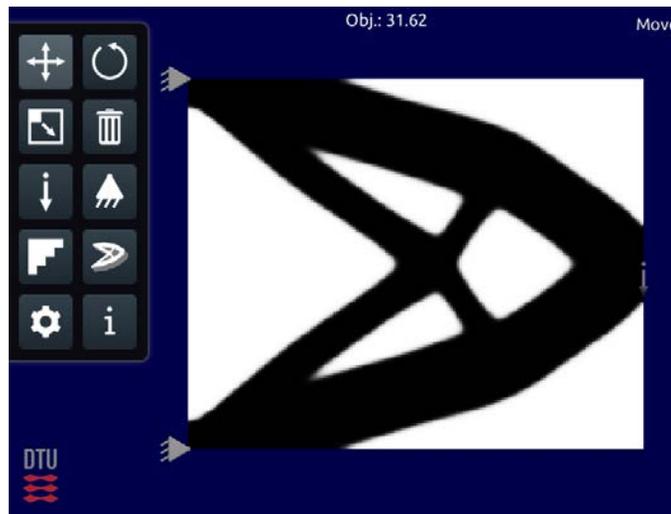

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Content

1 Main screen

TopOpt 2D allows the user to perform 3D interactive topology optimization in real-time. The App is available on mobile devices running iOS or Android as well as for the Windos, Max OSX and Linux platforms. Detailed information on how to download the app is found at www.topopt.dtu.dk under "Applets and Software". This manual explains the menu system of the app and provides turorials for basic usage. For a technical explanation of the app the reader is referred to [1,2,3,4].

The main screen with the default optimization problem and its solution can be seen in figure 1. The objective value for the current design can be seen at the center top of the scrren. The remaining menu icons and their functionality will be exaplained in the follwing.
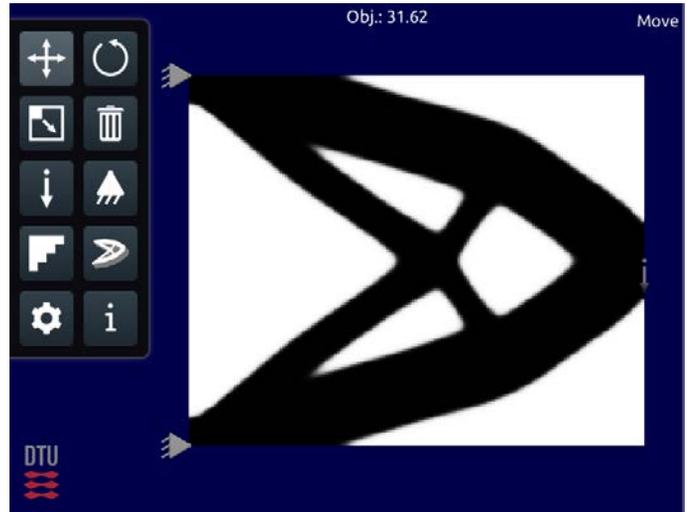

Figure 1: The main screen of the TopOpt app

1.1 Menu icons

Move – move loads, supports, passive areas.

Rotate – rotate loads and support.

Scale/distribute – make loads and supports distributed over rectangles/lines.

Delete – delete supports, loads and passive domains.

Load – add a load to the design domain.

Support – add a support to the design domain.

Passive domain – draw passive void/solid domains.

Export design for 3D printing (.stl).

Configuration menu – change volume fraction, mesh resolution, restart and pause.

General app information and links.

1.2 Loading.

A load is inserted using the load tool, and is by default a point load. However, pressing the load tool will reveal a dropdown menu with the following options:

[icon] Single load.

[icon] Change load case – the app allows three loadcases indicated by grey, red and green.

[icon] Scale load – note that all loads (also when distributed) have unit magnitude by default.

[icon] Gravity (iOS and Android only) – load direction from the device accelerometer.

1.3 Support.

Support are inserted as point supports by default. Once clicking on the support tool a dropdown menu appears with the following options:

[icon] Fully clamped point – locked in both spatial directions.

[icon] Roller support – fixed in one direction and free to move in the other as a rollerskate.

1.4 Passive domains.

Passive domain are inserted by drawing on the design domain. The regions drawn will not be included in the optimization problem and are therefore "passive". Both solid/material and void/air regions can be inserted, c.f.:

[icon] Solid domain – draw by mouse/finger on the design domain.

[icon] Void domain – draw by mouse/finger on the design domain.

Deleting a drawing can be done using the delete tool or by drawing on top of a passive region.

1.5 Export for 3D printing.

The TopOpt 2D app can export the optimized design for 3D printing. This is accomplished by pressing the export button, [icon], to open the export menu, see figure 2. From here you can send an .stl representation of the design to your email and if desired, you can apply mirroring. The default thickness is set to 10% of the design domain dimensions, but this can also be changed from the export menu.
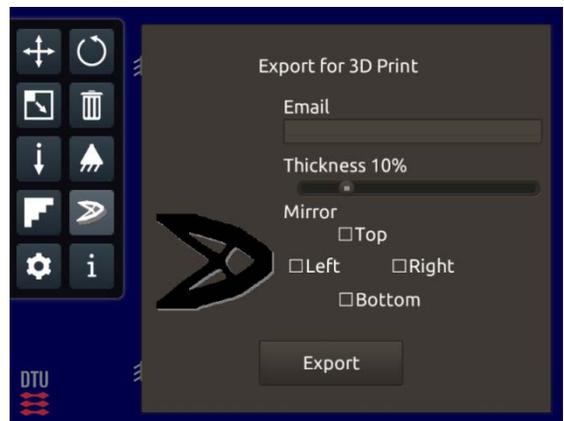

Figure 2: The export menu

1.6 Configuration.

Though many of the optimization settings are kept fixed to ensure a high degree of robustness and user friendlyness, the configuration tool, ⚙ ,allows you to change the following settings:

◤ Volume fraction slider

⬭ Reset optimization process – restart the process with a uniform starting guess.

⚙ Mesh resolution – choose between a number of predefined settings or pull/drag your own domain .

❚❚ Pause/Run the optimization process.


1.7 General information.

The last and final item in the menu simply provides an overview and simple explanation of how the app works. For this information and more, go to www.topopt.dtu.dk.
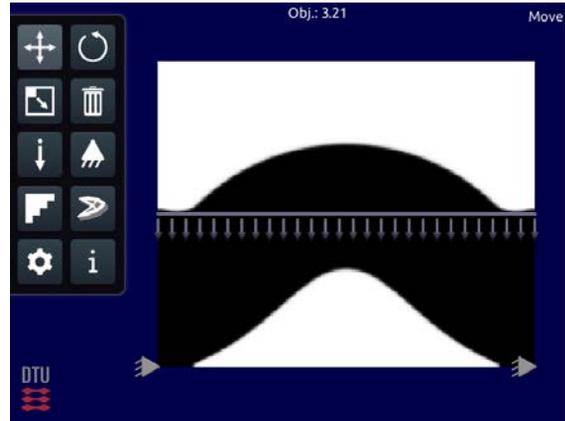
2 Tutorials

Unless otherwise stated all the examples shown in this tutorial has been run on a 200 x 160 mesh.
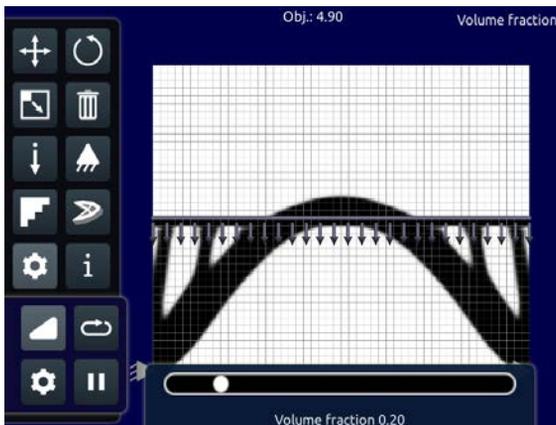
2.1 Bridge design.

In this first tutorial for the TopOpt app we will show you how to design bridge structures.
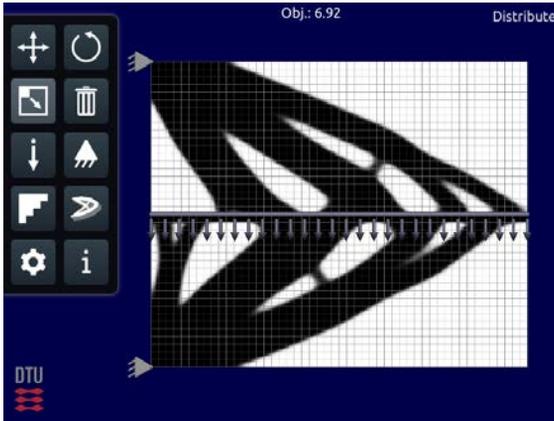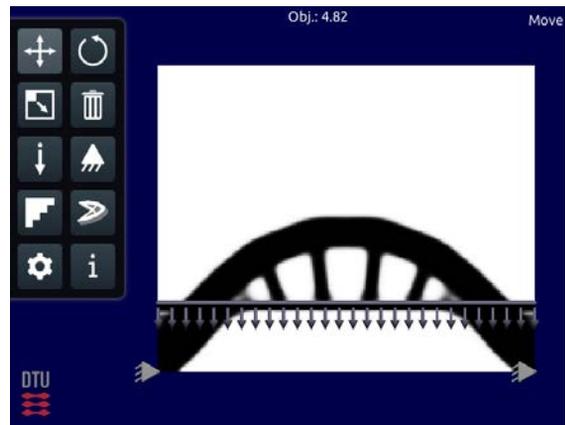

Step 1: Select the scale tool and stretch the load from right to left

Step 2: Move the top left support to the bottom right corner.

Step 3: Now open the configuration menu and click on the volume fraction slider. Set the material fraction to 20%.


Step 4: Now you should try to experiment with moving the load up and down, the supports into domain, add passive regions, etc.

2.2 Chair design.

This tutorial is intended as inspiration on how to design a chair with the TopOpt app.
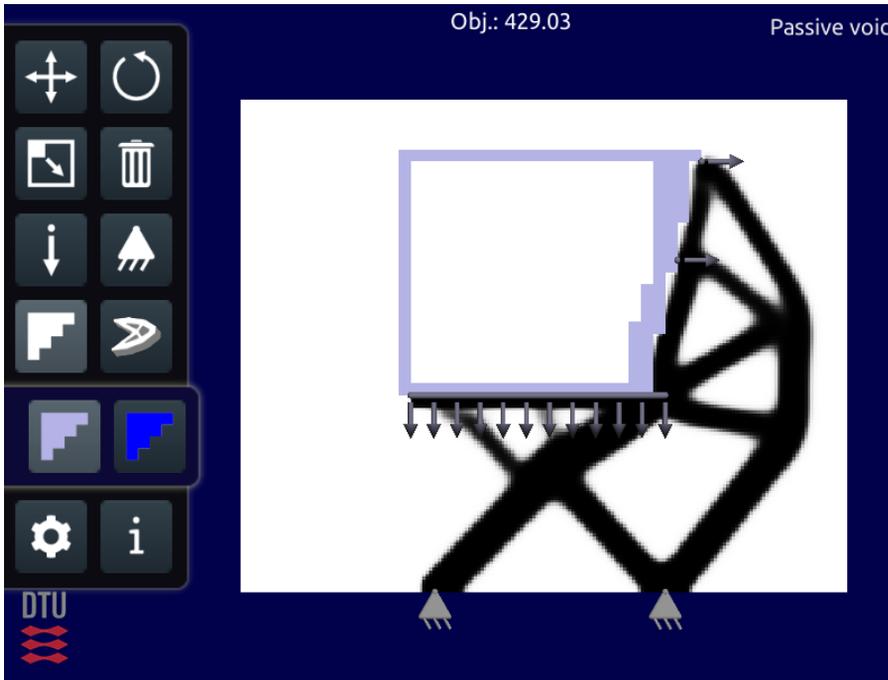
Example 1: The chair design is constructed using a single load case with the following settings: The downward "seat" load is 2.0 times larges than the two right oriented point loads. The volume fraction is set to 0.16 and an passive void domain is included to keep the seat free of material.
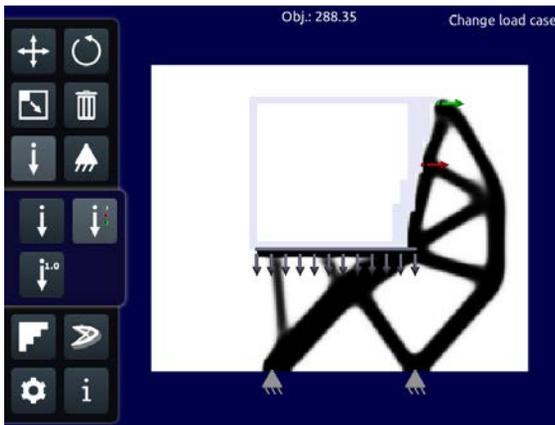
Example 2: Effect of making each load a separate load case.
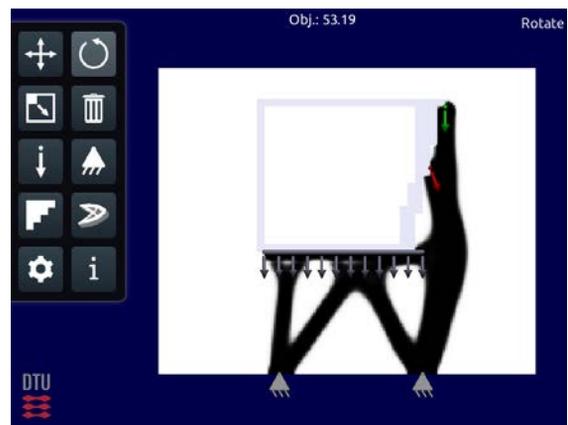
Example 3: Effect of changing the direction of the load cases.

3 References

[1] N. Aage, M.N. Jørgensen, C.S. Andreasen and O. Sigmund. Interactive topology optimization on hand-held devices, Struct Multidisc Optim, online first, 2012. (Uncorrected version available [here](#).)

[2] M.P. Bendsøe and O. Sigmund. Topology Optimization; Theory, Methods and Applications. Springer Verlag Berlin Heidelberg New York, 2nd edition, 2004.

[3] O. Sigmund. [A 99 line topology optimization code written in MATLAB](#), Struct Multidisc Optim, 21(2):120-127, 2001.

[4] E. Andreassen, A. Clausen, M. Schevenels, B. S. Lazarov and O. Sigmund. [Efficient topology optimization in MATLAB using 88 lines of code](#), Struct Multidisc Optim,43:1-16, 2010.