


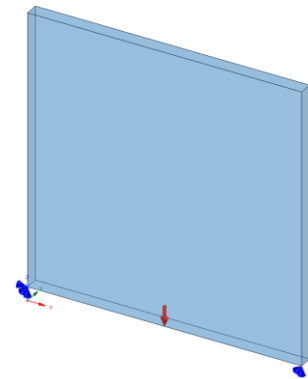
LimitState:FORM Design Exercises

Download the example files available at www.build-opt.org/fod2017


1. Revisiting the hand examples

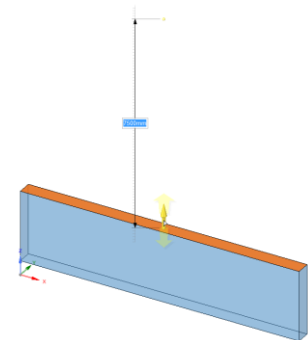
Example 1 – Full design freedom

- Open example1.scdoc (note that the software uses 3D design domains, so the model has a nominal thickness of 0.5m).
- *Solve*  the problem and compare the structure to that obtained using hand calculations.




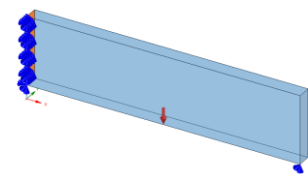
Example 2 – Reduced design domain

- Go to the *Design* tab and click *Select* .
- Show the Design Domain by checking the box next to *Design Domain* in the tree on the left-hand side.
- *Pull* (see Quick Reference) the top surface of the design domain down by 7500mm.
- Go to the *Optimize* tab and *Solve* the problem. Compare the structure to that obtained using hand calculations.
- This problem is also available from the download page as example2.scdoc





Example 3 – Additional support




- Add a *Face Support*  to the leftmost face of the design domain.
- *Solve* the problem and compare the structure to that obtained using hand calculations.
- This problem is also available from the download page as example3.scdoc



Feel free to also make changes to the design domain, loading or supports and investigate the effect this has on the solutions.

2. Editing solutions and investigating the influence of layout

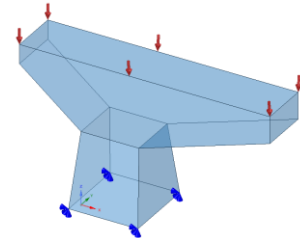
- Re-open and solve example1.scdoc
- Open the *Edit*  tool.
- *Remove* the middle four tensile 'spoke' members and click *Complete* . Note the effect on the efficiency.

- Now click *Re-solve* . Note the difference in the solution and efficiency due to the geometry optimization (see bar showing estimated structural efficiency near the top right of the screen).
- Use the *Merge Node*  and *Remove Member*  functionality to edit the structure so that it becomes a three spoke, two triangle truss. Check the difference in volume between this and the original solution.
- Explore the other *Edit* functionality, noting the effect of changes on the efficiency of the solution.

3. Extending to 3D geometries and investigating stability

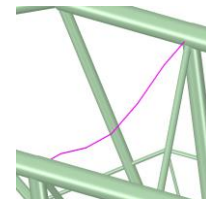
Step 1 – Solve

- Open the file *cantilever.scdoc* (as shown on the right)
- *Solve* the problem.



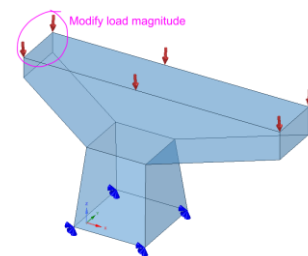
Step 2 – Elastic validation checks

- In the *Elastic Frame* group, click *Stability* λ .
- Examine the results of the stability analysis.
- To re-size the members and remove areas of high instability, click *Fix* – e.g. with a target stability load factor of 2.0.



Example 3 – Change the loading

- Increase the vertical magnitude of the two loads at the left-hand side of the structure to be 5000 kN (i.e. 5×10^6 N) in the downwards direction.
- *Solve* the problem and compare the structure to that obtained previously.
- If you wish, use the *Edit* tool to delete members to simplify the structure.
- Check the *Stability* of your proposed design.
- To display the structure with square hollow members, click the *Members* icon in the *Generate* group.



If you have time, feel free to make further changes to the design domain, loading and/or supports and investigate the effect this has on the solution.

4. Other examples

- Download and investigate the other files available at www.build-opt.org/fod2017
- For each file feel free to edit the solution and/or to modify the loading, supports, design domain etc.

5. Acknowledgements

We would like to thanks to LimitState for the use of their software LimitState:FORM: www.limitstate3d.com