



Master thesis project applied mathematics: shape optimization of an offshore wind turbine crane

Introduction.

The wind turbines we place at sea are getting higher and higher, since this allows for larger blades and consequently an increase in the harvesting of energy. Accordingly, offshore wind turbine placement cranes need to be able reach higher.

The company Tetrahedron is proposing a novel design for a crane which will be able to reach higher. We have to subject this design to different load cases and make sure it is strong enough to remain stable whilst being subjected to these different load cases.

We believe the currently available commercial programs do not offer enough flexibility to suffice to our current and foreseen demands. Therefore, we build our own dedicated software in the programming language Python.

To analyze our novel crane design, we need someone who masters mathematics and programming in Python and is interested in solving this problem.

Problem description.

The following facts define a closed and solvable problem.

- We consider the crane as a truss consisting of bars. Equivalently, we only consider deformation of the truss elements in axial direction.
- The crane is fixed to a jack-up ship. Equivalently, Dirichlet boundary conditions are imposed to the displacement variable.
- The crane has to lift a load.
- The weight and size of the crane is limited by the specification of the jack-up ship it is placed on.
- The overturning moment of the bearing between the crane and the ship has an upper bound.

How do we optimize the shape / topology of the crane with respect to its weight and overturning moment, within the limitations defined above?

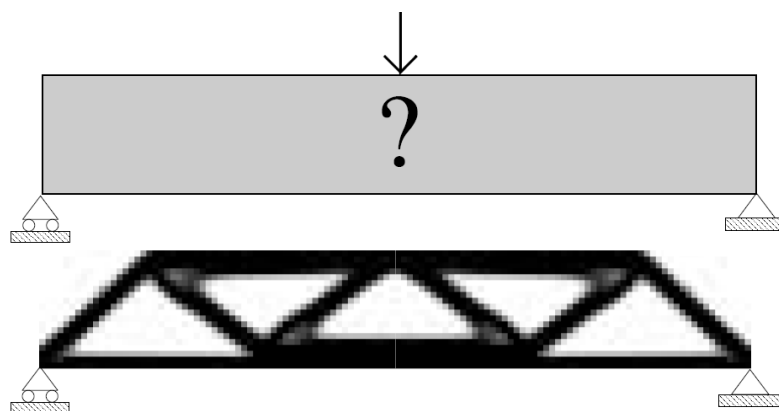


Figure 1. Example of topology optimization.

Literature.

- A 99 line topology optimization code written in MATLAB, O. Sigmund.
- Topology Optimization, O. Sigmund.



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What do we offer?

- An applied mathematics challenge.
- A first experience working at a company with masters of science in applied mathematics, mechanical, maritime and aerospace engineering.
- Financial compensation.
- A working place at Tetrahedron located at the Rotterdam Heijplaat harbor.
- Supervision by a mathematician.
- Short connection to your colleagues. We are a small team so waiting times are near inexistent.
- We will intensively apply the solution you build. This is not just a test. Your product will not just end up in the shelf. It will be used extensively when and after you finish your project.

What do you offer?

- Enthusiasm: you have an interest in this particular application.
- You like a mathematical challenge.
- You like programming, particularly in Python.
- Collegiality: you are a social person.
- Detailed report of your activities at Tetrahedron.

Contact.

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