Popular science summary of the PhD thesis

PhD student	Tim Felle Olsen
Title of the PhD thesis	A Stream Surface based approach to De-homogenization in Topology Optimization
PhD school/Department	DTU Compute

Science summary

* Please give a short popular summary in Danish or English (approximately half a page) suited for the publication of the title, main content, results and innovations of the PhD thesis also including prospective utilizations hereof. The summary should be written for the general public interested in science and technology. Before the thesis defence, the summary is sent to DTU's Office for Communication and Media and to the media *Ingeniøren*:

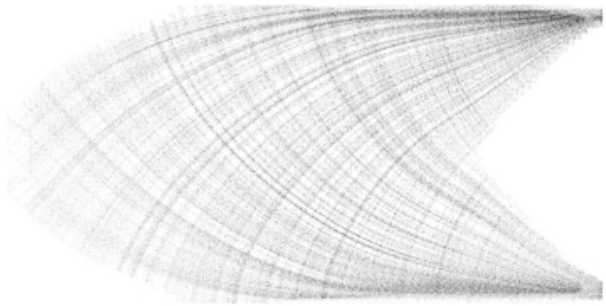
Nature have been our greatest inspiration for building things for ages. Dynamic and natural structures are created by designers and architects all over the world, but the structures might look like some-thing nature could have done, even though they might not be structurally sound.

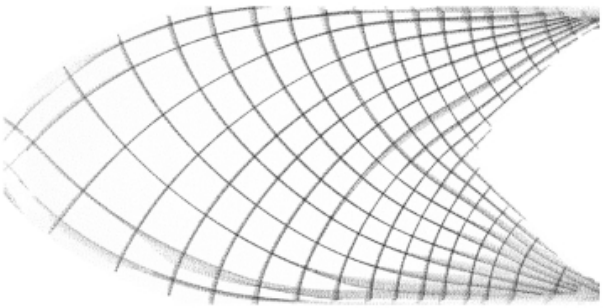
Topology optimization is a mathematical tool developed back in the 80's. The goal of the technology is used to optimize structures for buildings, mechanical tools and controlling the flow of fluids to name a few.
A side effect of the optimal design is that the structures end up looking very much like the dynamic designs the architects are so fond of currently. Design software are even including the topology optimization to help improve the work done by designers.

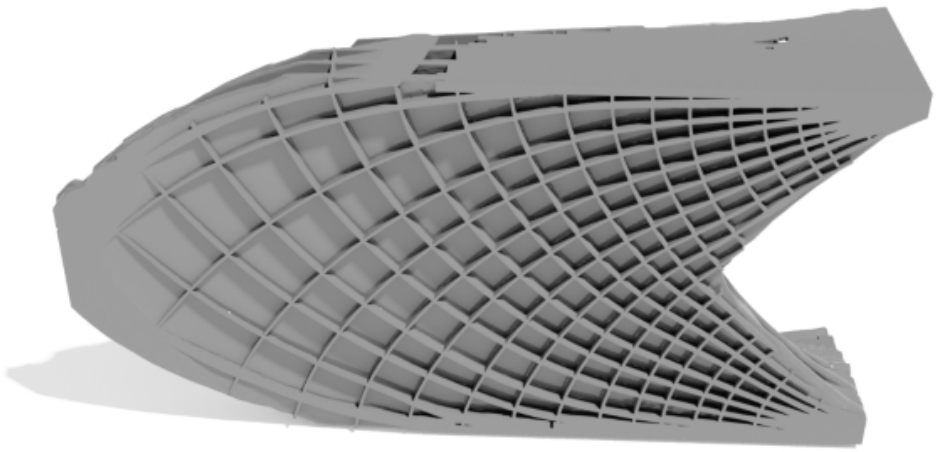
However, these optimal designs come with a price, computer power. Big projects require large amounts of computation time to complete. The article "Giga-voxel computational morphogenesis for structural design" in Nature from 2017 describe an attempt to create a new optimal internal structure for airplane wings. Their software spent 1 million CPU hours to get a result.

With this PhD we have made significant progress to reduce the computational requirements.

We took advantage of the Homogenization method in topology optimization already developed. This specific method estimates the stresses in an object as a vector field. Using knowledge from computer graphics we have high resolution models from these vector fields. These models might pave the way to reduce the computation cost of design processes currently in use.







Please email the summary to the PhD secretary at the department