Optimization of ship hull forms based on generalized B-spline surfaces

Student Research Project / Master Thesis

A variety of a vessel's properties depend on the hull form. An example are the hydrodynamic characteristics such as the total resistance of the hull. Often these characteristics are systematically optimized in order to save for instance fuel costs. The optimization setup for this task requires a parametrization of the hull geometry, an algorithm to generate the variants, and a method for the hydrodynamical computations. The latter computations may require a significant amount of time and therefore it is essential to keep the number of computation runs as low as possible. Most effectively this is achieved by minimizing the number of parameters which are used to parameterize the geometry. Unfortunately, the parametrization of geometry is a complex matter and the result is often a needlessly high number of parameters what eventually slows down the optimization process.

Based on generalized B-splines a hull form is defined in terms of a few control points. In the context of hull form optimization, the control points might be considered as parameters. This potentially simplifies the parameterization of the hull geometry. Moreover, only the points close to the region of the hull that is going to be optimized have to be considered what further reduces the number of parameters, see the example in Figure 1.

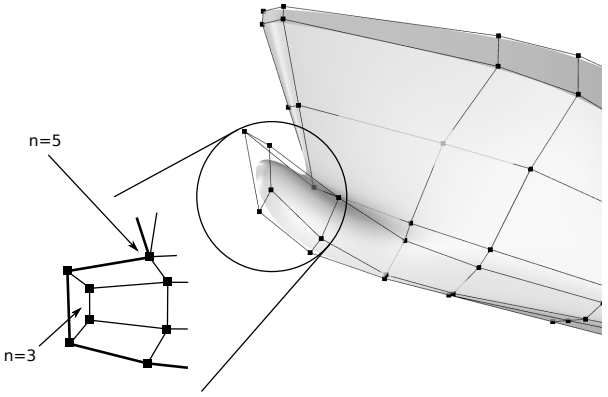

Figure 1: The illustrated control points define the shape of bulbous. If the bulbous bow is going to be optimized, it suffices to consider these points as parameters.

The goal of this work is to apply generalized B-splines in the context of hull form optimization. The control points should be used to parameterize the hull geometry. The result should be compared to other methods applied in the industry to parameterize the hull geometry. Those parameterization methods, the optimization algorithms, and the framework to trigger external software are provided by CAESES. Initially, the wave resistance is optimized using a potential code, but depending on the available time other problems might be considered.

The final working steps are coordinated with the supervisor not later than four weeks after the thesis has started.

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