Parametric generation of simple ship hull forms based on generalized B-spline surfaces

Student Research Project / Master Thesis

The hull form is one of the most important results of the ship design process. The early design covers the main particulars of a vessel. At this stage, the hull form is characterized in terms of integral parameters such as form coefficients. For later design stages a geometric representation of the hull form is essential.

An ongoing research project at the Chair of Ship Design promotes generalized B-splines for the representation of hull forms. The main advantage of this surface representation is the ability to use the control mesh for modeling. This provides a simple and robust method to define the hull geometry. Nevertheless, a method which turns the integral description of the hull form of the early design stage into an initial control mesh would be useful for the hull designer.

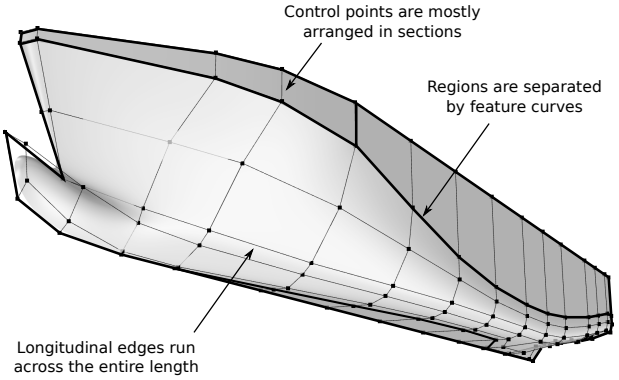

Figure 1: Typical structure of a control mesh. Different regions of the hull form are separated by feature curves. The control points are mostly arranged in sections in order to support the naval architect's view on a hull form.

The goal of this work is the parametric generation of simple hull forms based on a set of integral hull form parameters and the main particulars of the vessel. The integral hull form parameters include the displacement ∇, the block coefficient c_B, the main section coefficient c_M, and the longitudinal center of buoyancy LCB. The first step is to generate a sectional area curve for the hull form, the second step is to generate the corresponding hull surface. As the hull surface is going to be represented by generalized B-splines, the second step essentially covers the generation of a control mesh which reflects the sectional area curve. The control mesh is considered as the primary tool for hull form modeling in later design stages. Therefore the number of control points should be kept to a minimum and the general structure of the control mesh should match the naval architect's needs.

The final working steps are coordinated with the supervisor not later than four weeks after the thesis has started. This thesis requires good programming skills (`C++`) and the readiness to read up in the field of computational geometry.

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