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Computer-Aided Ship Design Approach for Non-Uniform Rational Basis Spline Based Ship Hull Surface Geometry

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Abstract : This paper presents a surface development and fairing technique combining the features of a modern computer-aided design tool namely the Non-Uniform Rational Basis Spline (NURBS) with an algorithm to obtain a rapidly faired hull form. Some of the older series based designs give sectional area distribution such as in the Wageningen-Lap Series. Others such as the FORMDATA give more comprehensive offset data points. Nevertheless, this basic data still requires fairing to obtain an acceptable faired hull form. This method uses the input of sectional area distribution as an example and arrives at the faired form. Characteristic section shapes define any general ship hull form in the entrance, parallel mid-body and run regions. The method defines a minimum of control points at each section and using the Golden search method or the bisection method; the section shape converges to the one with the prescribed sectional area with a minimized error in the area fit. The section shapes combine into evolving the faired surface by NURBS and typically takes 20 iterations. The advantage of the method is that it is fast, robust and evolves the faired hull form through minimal iterations. The curvature criterion check for the hull lines shows the evolution of the smooth faired surface. The method is applicable to hull form from any parent series and the evolved form can be evaluated for hydrodynamic performance as is done in more modern design practice. The method can handle complex shape such as that of the bulbous bow. Surface patches developed fit together at their common boundaries with curvature continuity and fairness check. The development is coded in MATLAB and the example illustrates the development of the method. The most important advantage is quick time, the rapid iterative fairing of the hull form.

Keywords : computer-aided design, methodical series, NURBS, ship design
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