3D Structural Design Tool for Monohull and Multihull Vessels
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ABSTRACT

An Ultimate Limit State (ULS) based design tool has been developed, which calculates discrete 2D ship sections for computational efficiency, while supporting a 3D geometry model [1,2]. This tool, called Brokkr, uses a medium fidelity methodology which allows the user to determine scantlings and plate thickness earlier in a design process and with less computational time than typical Finite Element Analysis (FEA). Individual structural components within the vessel can be analyzed to a level of accuracy superior to rules-based structural development. The ULS principles allow the tool to be equally accurate for calculating stresses and designing structure for monohull or multihull vessels. The 3D modeling aspect also allows for accurate assessment of structural weights, mass distribution, and secondary loading forces. The program has been validated against a midship section of the David Taylor Model Basin (DTMB) 5415 hull form, generating structure which was within 1% of the weight of the actual design scantlings [3]. An analysis based on the trimaran RV Triton is being performed currently, beginning with calculation of global and local loading for a model scale representation. These calculations will be validated with actual model test data. Then the full-scale Triton will be modeled with expected seaway loading, the loads will be analyzed by Brokkr, and a scantling design will be developed.

The program provides 3D visualization of hull sections. Its hierarchical approach will design a principal hull module, generally at midship where global bending loads are highest, and optimize plate thicknesses and stiffener size/spacing. This information is then utilized to govern design of secondary hull modules who inherit the same girder and stiffener spacing. Plate thicknesses are calculated using combined loading conditions, with redesign as necessary.

REFERENCES

[1] Knight, J.T. *Rapid, early-stage Ultimate Limit State Structural Design for Multihulls*. MARSTRUCT (2017).
[2] Ogdon, A. B., Collette, M. D., & Singer, D. J. *Critical Cuts Method*. (2012).
[3] Cope, N. and Knight, J. *Verification of an Automated Structural Design Procedure using Ultimate Limit States (Pending)*. PRADS (2019).