structural analysis of a yacht in waves.

SAFE SAILING

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Goal

Yachts experience heavy loads while crossing world oceans. Therefore, the structural integrity is an important part of yacht design & naval architecture. Standardized loads defined by regulatory requirements are usually followed for designing a yacht, e.g. RINA certification rules. In this case a structural integrity assessment was performed on the full yacht's structure. It was determined if stress levels satisfy the standards for different load cases.

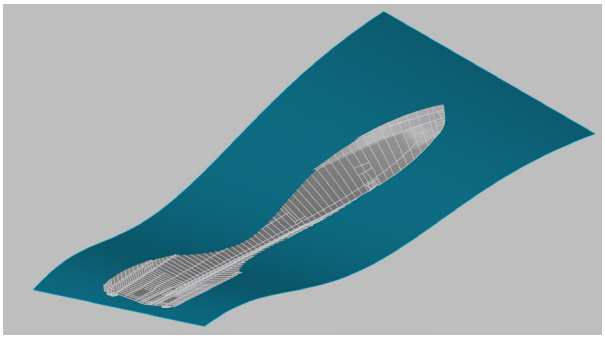

Figure 1. Visualization of wave for sagging condition.

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Approach

Maximum stresses were determined by finite element analyses for different load cases to observe their impact on the members. The load on the structure is composed of two separate parts. First is the distributed load from the construction and various weights onboard. The second part was determined from the hydrostatic pressure taking the wave condition into account. Two wave conditions were examined, where the boat is hogging or sagging, i.e. the wavelength coincides with the vessel length and there is either a wave crest or trough at the midship position. So, effects of hull girder stresses on hull openings & structural discontinuities were investigated. Moreover, the bottom structure was investigated when four gyro stabilizers generate forces and moments on it during operation.

Results

The analyses gave a critical insight of the stress levels of the full yacht. Based on the outcomes several local reinforcements were implemented to reduce high peak stress levels in the structure. Finally, the deformations of the yacht were used as an input for designing connections at different positions.

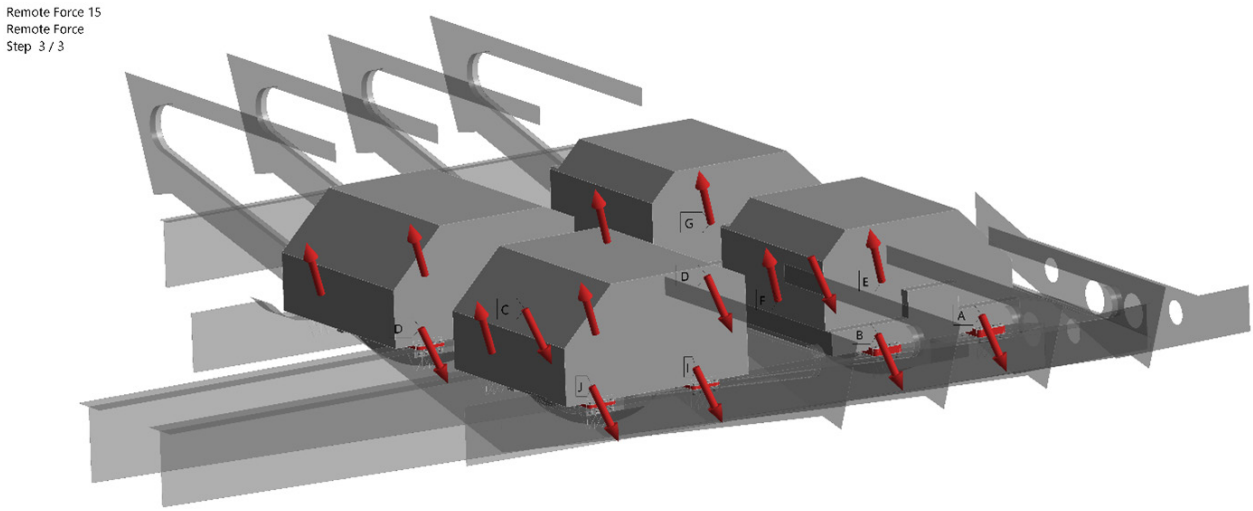

Figure 2. Gyro stabilizers with corresponding forces.

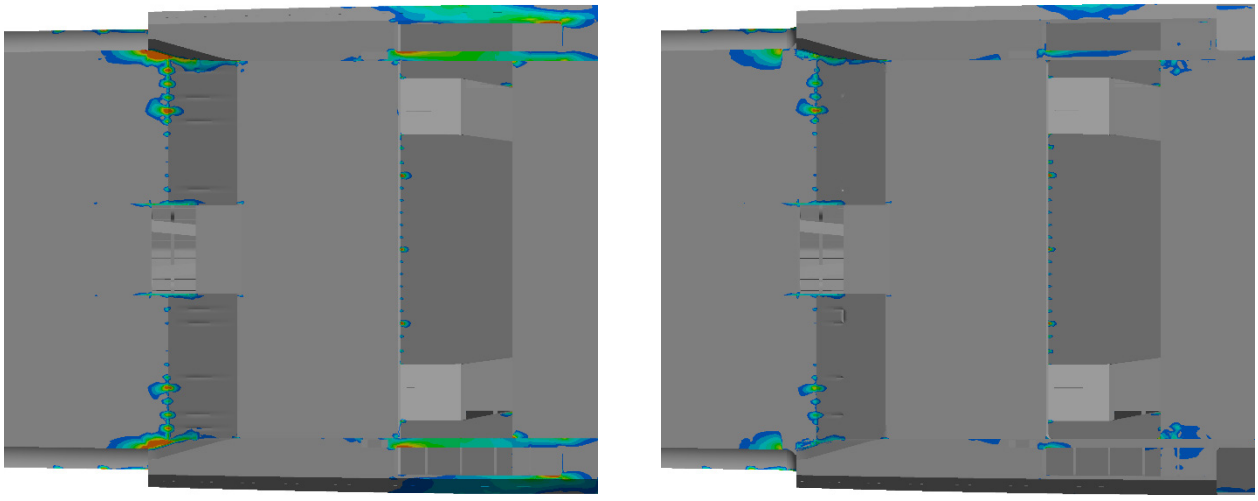

Figure 3. Results before (left) and after (right) optimization.