My 3rd year applied solid mechanics assessment involved the structural analysis of a lifting lug designed for use in liquefied natural gas carriers. This comprehensive analysis uses Autodesk Inventor Nastran, a Finite Element Analysis tool, to evaluate the capability of the lifting lug to withstand the mechanical stresses induced during the lifting of a Gas Combustion Unit. The GCU, integral to managing boil-off gas from the LNG, has a total mass of 36,000 kg, necessitating the lifting lug to be robust and reliable.

The report details the methodology for simulating the lifting process, specifying the static load conditions, material specifications, and the geometrical constraints of the lug. It includes a precise calculation of forces, meshing strategies for heightened stress areas, and a subsequent analysis to determine the Von Mises stress and vertical tip deflection. The results revealed that the initial design does not meet the industry-standard safety factor of 5, indicating a potential for structural failure under load.

To validate the FEA results, comparisons are drawn with previous successful applications of the software, supplemented by theoretical calculations using established mechanical engineering principles such as Castigliano’s Theorem.

This project not only demonstrates proficiency in applying advanced FEA techniques but also highlights the importance of safety and compliance in engineering design. Recommendations for design modifications are provided to ensure that the lug can meet the necessary safety standards. The project underscores the critical nature of detailed analysis and validation in the engineering design process, particularly in applications where safety is paramount.

Skills used:

Fusion 360

Inventor

Inventor Nastran

Matlab Modelling

Applied Solid Mechanics