Design of an autonomous offshore crane

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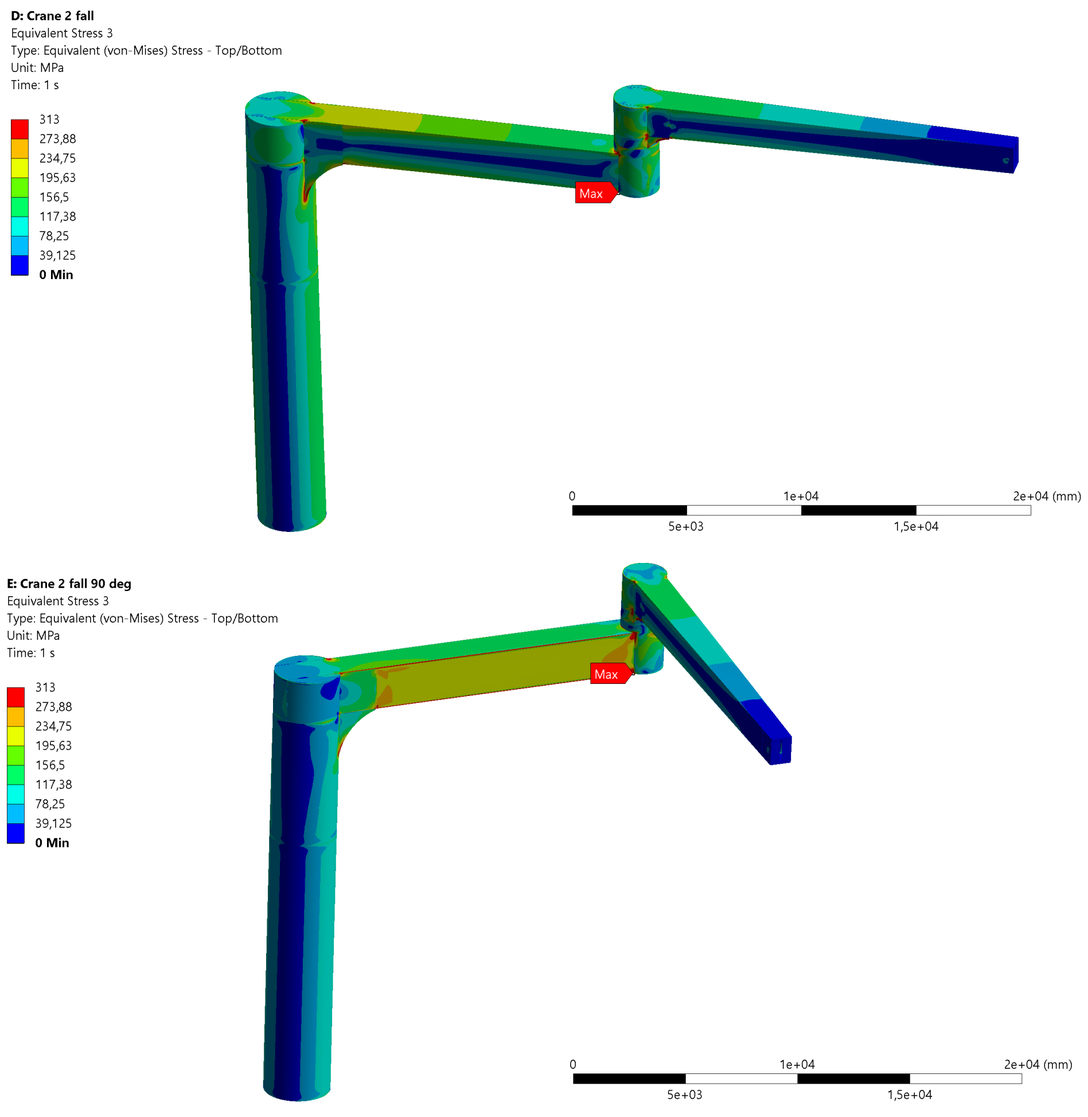
The aim of this project is to carry out a stress analysis and load chart calculation of an autonomous offshore crane.

Introduction

The thesis is given by IKM Tech Team Solutions. The crane is designed in accordance with NS-EN 13852-1:2013. Specifications are given by NORSOK R-002 G11.1;

- The crane shall be able to lift a minimum load of 15 tonnes from a supply vessel at a horizontal distance of 32 m from the outside of the installation, measured at sea level, at a significant wave height H_s = 0 m;
- The crane shall be able to lift a minimum load of 5 tonnes from a supply vessel at a horizontal distance of 20 m to 30 m from the outside of the installation at minimum required horizontal and vertically hook velocities, measured at sea level, at significant wave height H_s = 6 m.



Method

- Manual calculations in Mathcad and Excel to strengthen and optimize the crane.
- Calculations are done for buckling on pedestal and boom cross sections and maximum utilization factors for each crane component.
- Macros are used in Excel to perform calculations and adjust the maximum load capacity based on the calculated maximum utilization factors.
- Load charts are created for lifting with single and double fall at different boom angles and significant wave heights (H_s).
- A SpaceClaim model and Ansys simulation of the crane is performed when lifting with single and double fall with a straight boom and at a 90 degree boom angle.

Result and conclusion

The crane was successfully designed in accordance with the given specifications. Results from the manual calculations show that the highest utilized components are the hoist winch and wire rope.

The maximum lifting loads for significant wave height H_s = 0 m and H_s = 6 m with a boom radius at 4 – 32 m when lifting with one and two falls are presented in the table.

An FEA analysis to the structure has been performed by ANSYS. The results are in line with the analytical calculations.

SIGNIFICANT WAVE HEIGHT	LOAD, 1 FALL	LOAD, 2 FALL
H_S = 0 m	15.9 tonnes	34.0 tonnes
H_S = 6 m	5.5 tonnes	10.8 tonnes

Høgskulen på Vestlandet

expo

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