Fatigue Assessment of Casings in a Severed Conductor

Client Confidential

North Sea

The Problem

Our client's facility consists of a four legged liftable steel jacket, which supports an integrated topsides deck in the northern North Sea. The surface section of this tied back well consists of a number of concentric tubulars. Inside the outer conductor is an intermediate casing, followed by a production casing, and a string of production tubing. The conductor on the platform failed during a planned ROV survey, and the location of the failure was within the conductor guide ring, where it was discovered that the centraliser was missing. A subsequent inspection showed that the conductor was oscillating within the constraints of the conductor guide.

MMI were requested to assess the interaction between the conductor and co-axial casings, and to undertake a fatigue assessment of the casings at the failure elevations and the nearest coupling locations.

Our Approach

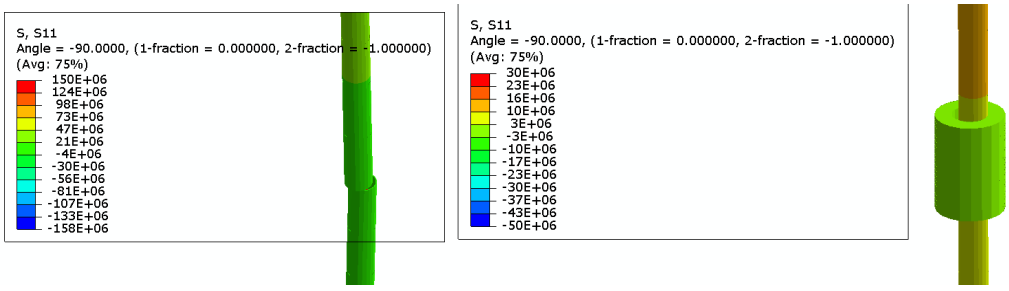
We built a full 3D beam-based model of the conductor containing co-axial casings using ABAQUS. The co-axial casings in the conductor were explicitly modelled instead of a simplified model based on effective section properties. Centralisers on the conductor and both intermediate and production casings were also included in the model.

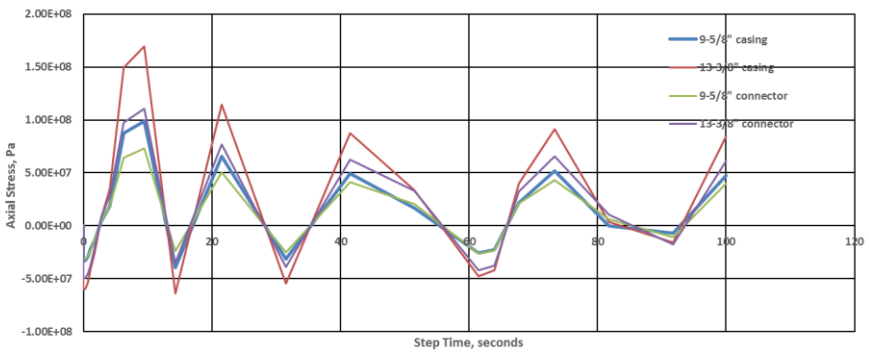
First order wave effects, which included direct wave loading on the conductor, were studied by carrying out ABAQUS/Aqua analyses, wherein steady current and wave loading are applied to submerged or partially submerged structures.

The FE predicted axial stresses in the casings and at coupling locations, which were subsequently used in a fatigue assessment based on DNV-RP-C203 S-N curves.

Outcome

The fatigue assessment demonstrated that the intermediate and production casings had a very low cumulative fatigue usage from the time of conductor failure to date. A similar analysis was also undertaken to predict stresses in the casings after installation of a temporary centraliser at the conductor failure location. The analysis demonstrated effectiveness of the temporary centraliser in limiting conductor displacement and significantly reducing axial stresses in the casings under wave loads.





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