

Fatigue Analysis of Spread Mooring Line

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Abstract : Offshore floating structure under the various environmental conditions maintains a fixed position by mooring system. Environmental conditions, vessel motions and mooring loads are applied to mooring lines as the dynamic tension. Because global responses of mooring system in deep water are specified as wave frequency and low frequency response, they should be calculated from the time-domain analysis due to non-linear dynamic characteristics. To take into account all mooring loads, environmental conditions, added mass and damping terms at each time step, a lot of computation time and capacities are required. Thus, under the premise that reliable fatigue damage could be derived through reasonable analysis method, it is necessary to reduce the analysis cases through the sensitivity studies and appropriate assumptions. In this paper, effects in fatigue are studied for spread mooring system connected with oil FPSO which is positioned in deep water of West Africa offshore. The target FPSO with two Mbbls storage has 16 spread mooring lines (4 bundles x 4 lines). The various sensitivity studies are performed for environmental loads, type of responses, vessel offsets, mooring position, loading conditions and riser behavior. Each parameter applied to the sensitivity studies is investigated from the effects of fatigue damage through fatigue analysis. Based on the sensitivity studies, the following results are presented: Wave loads are more dominant in terms of fatigue than other environment conditions. Wave frequency response causes the higher fatigue damage than low frequency response. The larger vessel offset increases the mean tension and so it results in the increased fatigue damage. The external line of each bundle shows the highest fatigue damage by the governed vessel pitch motion due to swell wave conditions. Among three kinds of loading conditions, ballast condition has the highest fatigue damage due to higher tension. The riser damping occurred by riser behavior tends to reduce the fatigue damage. The various analysis results obtained from these sensitivity studies can be used for a simplified fatigue analysis of spread mooring line as the reference.

Keywords : mooring system, fatigue analysis, time domain, non-linear dynamic characteristics

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