

S-N-based Fatigue Damage Modelling of Offshore Structures

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Abstract:

The problem of variable amplitude loading is commonly assessed by the Palmgren-Miner linear damage rule. Since the linear damage summation does not take into account the loading sequence effect, Miner's rule yields inaccurate estimations of accumulated fatigue damage in structures under variable amplitude loading steps. The linear summation model is conservative for low to high amplitude loading, whereas failure will occur prematurely for high to low amplitude loading. Several researchers have proposed various damage models to improve the estimation of remaining fatigue life. Despite the inherent flaw of the linear model and the research efforts thus far, it is yet common to adapt the Palmgren-Miner linear damage rule in various standards and recommended practices such as Eurocode and DNVGL. Consequently, highlighting the demand for further research within the field of damage accumulation. Herein, the problem of cumulative damage is assessed, and a model is proposed in light of the theory of S-N fatigue damage envelope, proposed by Pavlou. Consequently, resulting in a damage function which only depends upon the commonly adapted S-N curve, to estimate fatigue damage and remaining fatigue capacity.