# USE OF LIMIT ANALYSIS METHODS TO ASSESS THE STRUCTURAL CAPACITY OF SUBSEA SYSTEMS AND COMPONENTS

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## ABSTRACT

With advances in computational modeling techniques, limit load methods are gaining wider acceptance as a tool for determining the integrity of structural and pressure containing systems. The objective of a limit load analysis is to size a vessel or structure considering nonlinearities such as elastic-plastic material properties and non-linear strain-displacement relations. It is even possible to use experimental methods to determine the loading capacity of a structure [1]. In subsea and offshore environments, there are a variety of conditions that can lead to the need for limit analyses.

Case studies are presented in this paper that feature scenarios including external pressures, pipe axial tension and bending, and dropped object impact loads. The limit load technique applies an appropriate initial magnitude for each load type and uses an analysis model or test set-up to increase the load until a lower bound load is calculated. The lower bound value is determined by incrementally increasing the load until the structures can no longer support additional loading without gross plastic deformation.

This paper presents how limit load techniques were used to address the structural integrity of four engineered systems. These include the design of a subsea vessel under elevated external pressures, assessing the remaining buckling resistance of a dented subsea flowline, determining the effects of impact loads on an export riser, and evaluating the ability of a composite repair to reinforce a corroded riser using experimental methods.

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