Title	Review of Analysis of Explosion Response
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Executive Summary	This report presents the results of the assessment of analytical techniques that are in current use for the design of offshore oil and gas structures to resist explosion overpressures. The research has found that the hand calculation and computer-aided applications fall into the same two general categories. These are static analysis and time-domain analysis. It is not necessary to use Finite Element based techniques to gain advantage from non-linear responses. The primary concern in the assessed literature is validation of the methods being applied and the skills of the users. The literature considers two methods in detail, the single degree of freedom (SDOF) method and the non-linear time-history analysis method. The SDOF method is based on the work of Biggs presented in his book "Introduction to Structural Dynamics". The method is shown to produce reasonable results if the structure to be analysed can be represented reasonably accurately by a single degree of freedom system, and if the method is applied by suitably experienced engineers. The non-linear time-history analysis method is a technique based on the Finite Element Method. The method has the ability to consider a broad spectrum of structural aspects, being widely considered the ultimate method. The method is however, complex and the recommendation that it be used by experienced analysts is often repeated. The report finally considers the place of the modal response spectrum method in the design analysis of structures to resist explosion overpressure. The method is not at present in common usage for offshore engineering, although it is widely used in the civil nuclear, Defence and aerospace industries. The conclusion is drawn that the modal response spectrum method could: • provide results of a higher accuracy than the SDOF method for certain structural forms; • be suitable for the analysis of simple and complex structures; • capture many of the key dynamic aspects of structural dynamic response, with the concept being easier to apply than the time-history FEA methods; • include a more realistic representation of the load-bearing capacity with a lower • computational requirement than the time-history techniques, hence taking account of structural redundancy; • reduce some of the over-conservatisms in the analysis of the response of structures to explosion overpressure; • models used for the modal response method are easier to validate than full linear and nonlinear time-history models; and • The experience required to run the models is less than that required for time history analysis. • Modal response analysis is available in most of the commercial programs used for structural analysis. The method is based on the extraction from the structure matrix of the structure natural frequencies; these are then used to extract loadings from a spectrum representing response frequency and associated loading. Since the method is elastic and generally will use models built for the normal structural analysis, it lends itself well to the design of blast resistance. In addition, for the back fitting of existing structures, the method is readily available to carry out preliminary dynamic response calculations using the existing structural models.

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