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Development of Flexible Risers Monitoring Methodology Using Acoustic Emission Technology

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Abstract

Deep water oil and gas exploitation in Brazil has considerably increased the utilization of flexible pipes in conjunction with floating production systems. Acoustic emission is a nondestructive testing technique that could be used for detection of tensile armour wire rupture, which is a critical failure mode of flexible risers. This paper describes the experimental program implemented including: laboratory results, field experience and the model to define if there is or no armour wire rupture. It was concluded that acoustic emission can be used as a tool to help the integrity assessment of flexible risers using the setup and model developed during this experimental program.

Introduction

Deep water oil and gas exploitation in Brazil has considerably increased the utilization of flexible pipes in conjunction with floating production systems. Periodic inspections have detected considerable occurrence of damage on the top section of flexible risers which may affect their structural integrity. In order to mitigate the progression of these damages monitoring techniques have been studied and implemented for a continuous flexible riser integrity assessment, apart from the inspection program. Acoustic emission is one of these techniques for detection of tensile armour wire rupture. This paper describes experimental program implemented including: laboratory results, field experience, equation to define if there is an armour wire rupture or not. It was concluded that acoustic emission could be used as a tool to help the integrity assessment of flexible risers.

Acoustic emission is a physical phenomenon occurring within materials. The term acoustic emission is used to define the elastic energy released within a material in the form of transient elastic waves. The application of load and/or the presence of a harsh environment produce internal modifications such as crack growth, local plastic deformation and corrosion, and in some cases phase changes. Thus it provides some information about the internal behavior of the materials under consideration. The waves are detected by means of suitable sensors which make it possible to convert the surface movements of the material into an electric signal. These signals are processed by appropriate instrumentation with a view to indicating and locating the acoustic emission sources. Figure 1 shows the schematic principle of the acoustic emission testing. [AFIAP, 2004]