New generation of flexible risers equipped with motion capture
Morphopipe System

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Summary

Structural dynamic monitoring is a fundamental element for predictive maintenance of flexible risers, subject to harsh constraints. The collaboration CEA/Technip resulted in a new solution with MEMS accelerometers, called Morphopipe. The flexible riser equipped with the Morphopipe system allows the estimate of the consumed service life via the curvature knowledge. The context, the technology and the algorithms will be mentioned, as well as the industrial integration at manufacturing stage and the added values of such a system.

CONTEXT, CHALLENGES

Structural monitoring of flexibles

- Flexible risers: multilayers structures to convey oil/gas offshore
- Harsh constraints over 20 years
- Curvature at the bend stiffener: main parameter to estimate (detection of extreme events, involved in cumulated fatigue)
- Needed to improve safety and will potentially extend lifetime

Use of MEMS accelerometers in manufacture challenge

- Expertise in shape/motion capture via inertial sensors in CEA
- Need to use highly performant 1-axis MEMS accelerometers
- Instrumentation have to be embedded, in a non-accessible zone during life time, with a process compatible with each project [specific requirements: water depth, sea state, pressure, temperature…]

METHODOLOGY AND VALIDATION

The data acquisition unit and supervision software has been specifically developed based on Cyxense® from Cybernetix. It allows:

- The supervision of the electronic cards (power supply, communication) for up to ten risers at the same time
- Administration and logs (user accounts, health check, historical logs)
- Display of data (maximum, direction, profile, localisation) and alerts
- Possibility for standard communication protocol to other system (Modbus)

MONITORING SOFTWARE

The calculated curvature is used to define the bending plane location and value of maximum curvature. It will potentially improve safety and will potentially extend lifetime.

ASSOCIATED SERVICES

- Riser integrity management can be performed at different levels. As a first indicator, the system compare the actual curvature and angle versus the expected envelop. This validate the expected and safe riser behaviour and alert the operator if required. Data from Morphopipe combined with other data from monitoring systems or inspections can give refined indication on the status of the riser. Morphopipe will provide valuable data for accurate re-assessment of the fatigue. The calculated life span of the riser can be updated.
- Through FORSYS Subsea, the alliance between FMC Technologies and TECHNIP, Morphopipe data will act as an additional enabler of pro-active condition-based maintenance so as to increase uptime and accelerate decision time.