FlexIQ™ – Redefining Flexible Riser Integrity Management

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The relation of NDT and Integrity assessment

- **NDT tools (like ILI tools) need to be developed that find defects relevant to the integrity of a structure**
  - High Resolution MFL pigs were developed in order to not only find corrosion but also to leave it unrepaired where possible. (British Gas 1980ies)
  - An eddy current pig was developed to find internal fatigue cracks. The threat is now considered of minor importance. The tool is not available any more (Pipetronix 1980ies)
  - The shear wave UT crack inspection pig was developed after calculating what the relevant crack length is. (Pipetronix 1990ies)
The relation of NDT and Integrity assessment

- Methods of integrity assessment have to consider the reliability of the input data
  - *DNV RP F101 make ample reference to the accuracy and reliability of the measurement.*
  - *Using an FAD approach for crack assessment can result in all findings to be rated “not permissible” because properties are not sufficiently determined*
FEM in structural integrity assessment

- **The most detailed method to calculate the strength of components under various kinds of loads**

- **What is difficult about the modelling of Flexible Riser?**
  - **Layer structure, number of surfaces, edge effects**
  - **Small single wires**
  - **Cyclic loading with complex spectrum of loads, wave action**
  - **Friction in between layers**
  - **Size of the structure in relation to size of stress concentrations**

J. Xie, C-FER, Finite Element Calculation for structural performance of offshore platforms, 2012 Simula Conference

In bulk material elements can be larger depending on loads.
With fine structures number of elements become high with high computational effort.
Flexas™ Example for riser stresses

20 pitch (12m) hang-off simulation, 80 million DoFs nonlinear dynamic simulation

34 wire stress time-histories

Total computation time for this nonlinear dynamics simulation (FLEXAS™): 300 secs
MEC-FIT™ by Innospection

- MEC-FIT™ is an adaptation of the well established MEC-technology to flexible riser inspection. It uses an Magnetic Eddy Current technique to find defects in armour layer.

ROV based deployment

Top-side deployment
MEC-FIT Qualification

- All structures are different.
- System is qualified for every project.
Signals of single wires can be separated. Amplitude depends on depth and opening for through cracks.
MEC-FIT™ Data Analysis

- Several levels of detail
- Overview for context information
- Impedance plane for defect classification
Sample report page
Wire misalignment
What does the combination of the two methods allow?

- Combination of defects, what is the effect on lifetime
- Allowable gap-sizes in case of wire-misalignment
- Establish permissible operating conditions for a certain wire distortion detected by inspection
FlexIQ™
Cycle of continuous integrity management

Considered two aspects of flexible riser inspection.
FlexIQ expands to all aspects of flexible riser integrity.
Conclusions

• *FlexIQ™ offers a fully integrated service for inspection, analysis, and data management.*

• *It is now possible to apply methods of continuous integrity assessment to flexible risers just the way it is known to rigid pipe.*

• *In consequence a continued service of flexible riser will become possible, where lifetime of an asset does not depend on its age but its condition*