

FLEXAS™ for Advanced Simulation of Flexible Risers

Client Benefits

- Independent assessment of vendor flexible design and configuration
- Reliable fatigue life estimates from high-fidelity and computationally efficient global riser simulations
- Incorporate in-service inspection data (damaged wire) directly into global simulation for continuous monitoring of flexible fatigue life
- Improved flexible riser integrity management planning and risk mitigation strategies
- Support decision making on flexible riser replacement therefore minimizing operational costs

Introduction

- Global dynamic simulation of flexible risers remains a major industry challenge due to prohibitive computation times
- Computational constraints have required the industry to settle for inadequate stress estimates for fatigue assessment
- Unreliable life predictions have resulted in increased risk of unexpected flexible riser failures as well as unnecessary replacements
- An improved solution is needed by the industry for the safe and economic operation of flexible risers in increasingly demanding offshore field developments

FLEXAS advanced nonlinear dynamics solver executes fully coupled global nonlinear dynamic simulations for efficient, reliable fatigue life predictions.

FLEXAS enables efficient flexible riser dynamic simulations of detailed multi-layered finite element models in large scale configurations with direct armor wire stress recovery under irregular wave loadings.

FLEXAS Advanced Solution

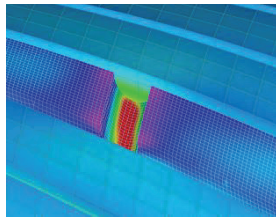
- FLEXAS solver removes traditional computational constraints through Nonlinear Dynamic Substructuring (NDS), which allows for a high degree of accuracy and computational efficiency
- FLEXAS global flexible simulations integrate detailed finite element models with solid element armor wires for accurate dynamic response and stress calculation
- FLEXAS enables recovery of time-consistent armor wire stress time-histories directly from the global simulation under irregular wave loads
- FLEXAS advanced friction algorithm captures stick-slip and bending hysteresis phenomena

Flexible Riser Integrity Management

- Armor wire damage detected during inspections are incorporated into the global FLEXAS model
- Flexible riser remaining fatigue life is estimated based on accurate armor wire stress time-histories at the damaged location



Damaged wire



Damage incorporated in flexible global model

Publications

ISOPE2016: Computationally Efficient Simulation of Flexible Risers via Nonlinear Dynamic Substructures: Numerical and Experimental Validation

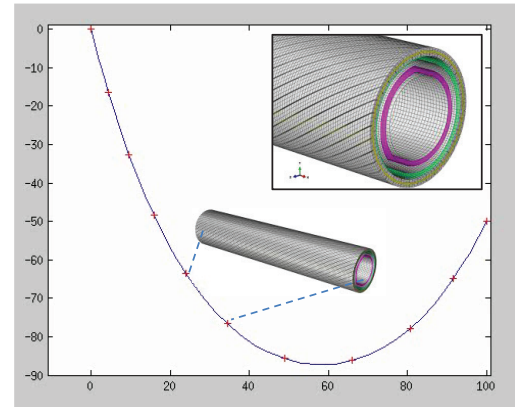
A. Majed, L. Chinello, N. Cooke - INTECSEA
G. Rombado, W. Kan - ExxonMobil

ISOPE2015-TPC-0915: Computationally Efficient Flexible Pipe Mechanical Bench Test Simulations Using Nonlinear Dynamic Substructures

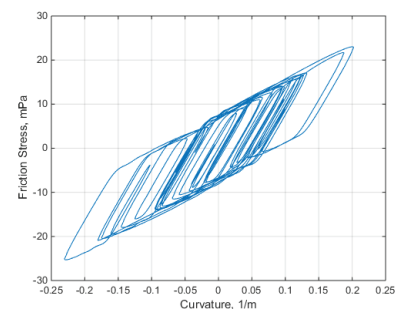
A. Majed, L. Chinello

OMAE2014-24287: A Nonlinear Substructuring Approach to Global Dynamics of Flexible Riser Systems

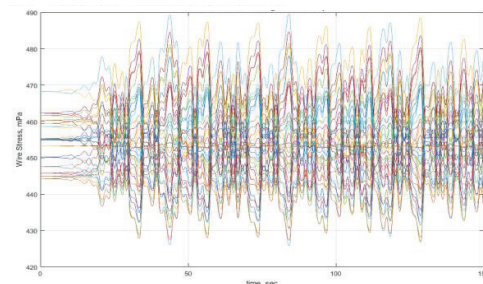
A. Majed, P. Cooper



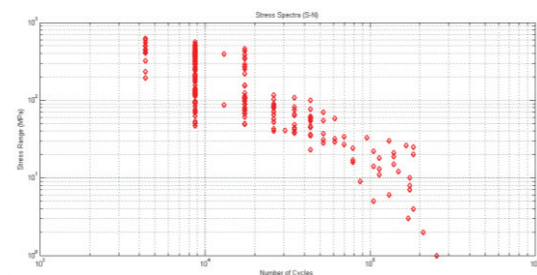
Detailed multi-layered flexible finite element models integrated in global analysis



Bending hysteresis captured by tensile armor kinematics and stick/slip friction



Recovery of each tensile wire stress time-history under irregular wave load directly from global simulation



Reliable Fatigue Life Predictions

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