# UFLEX software

Umbilicals - Power Cables

UFLEX is a special purpose program system for non-linear stress analysis of complex umbilical cross-sections.

MAIN FEATURES

The UFLEX program system consists of the UFLEX2D special purpose FEM module and utility programs for extracting and visualizing key results.

UFLEX2D is used by the industry both for the purpose of producing capacity curves and for performing fatigue analyses of umbilical cables. For fatigue analyses, a global analysis is performed for obtaining the correct cyclic variations of bending and tension. These loads are applied as input to local analysis performed using UFLEX2D; subjecting the umbilical cable to temperature, internal and external pressure loads in addition to the axial tension and bending cycles.
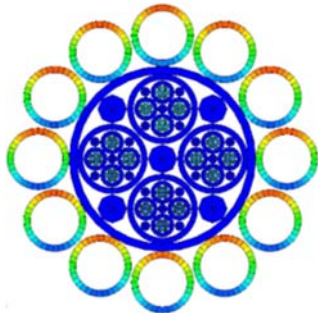
CAPABILITIES

• Complex cross-section geometries

• Contact and friction stresses

• Contact definitions with tunable parameters for contact searches, friction, surface stiffness etc.

• Non-linear relation of curvature and bending moment

• Ovalization of helix components and cross-section geometry ovalization

• Recursive definition of cross-section geometry allows nested helices

• Non-linear material models

• Initial strains

DEVELOPMENT

1990s

• BEAM and SHELL elements for umbilical components
• Linear and non-linear material models, e.g., thermoelastoplastic, hyperelastic and resultant
• Internal and external pressures, thermal loads
• Local and global loads and prescribed displacements
• Kinematic relations between helical components, merging of layers, contacts and shells

2000s

• Constant strain triangular (BEAMSHELL) elements, e.g., used for fillers
• BITUMEN material model
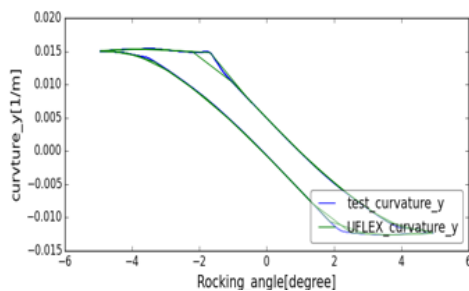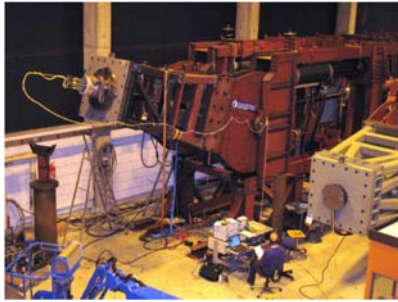• THICKWALL stress results for SHELL elements

2010s

• Tuning of slip levels to account for contact forces resulting from applied loads
• Choice between work-based and strain-based friction models
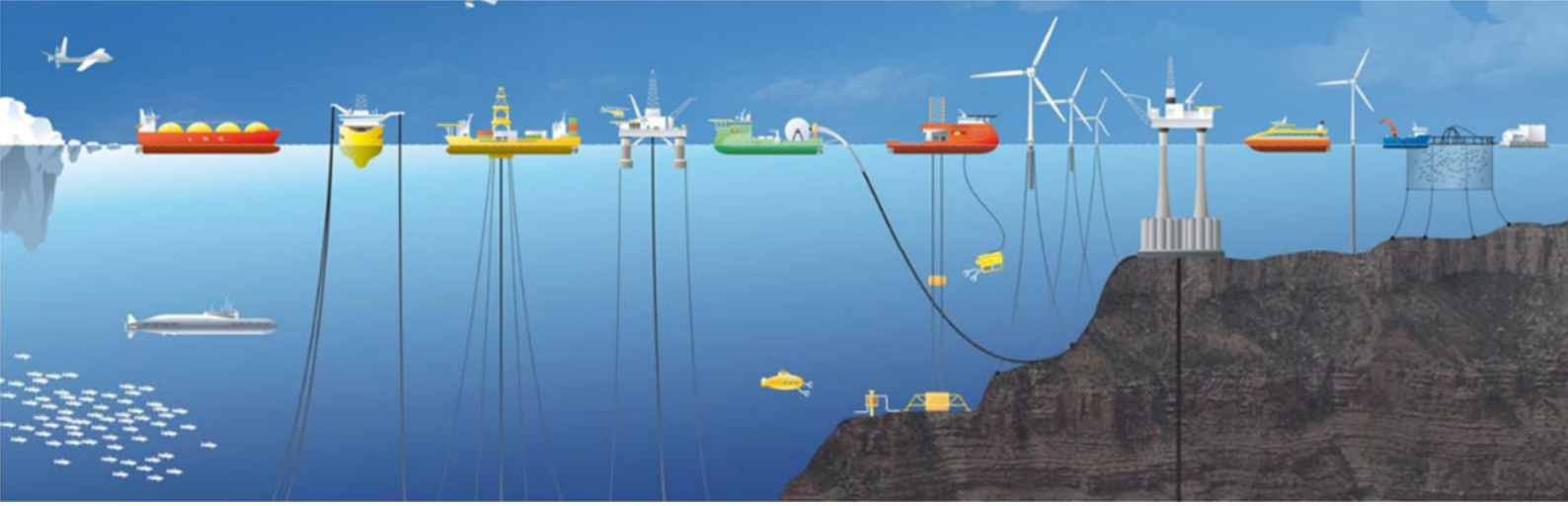
VERIFICATIONS

- Analytical solutions

- Commercial software (ABAQUS)

- Published test data

- Measurements by performing full scale test (FBG)

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