THE UNIVERSITY OF WESTERN AUSTRALIA

Oceans Graduate School

SUT Society for Underwater Technology

Soil Inelasticity and VIV Fatigue of Pipeline Spans

Speaker: Ralf Peek
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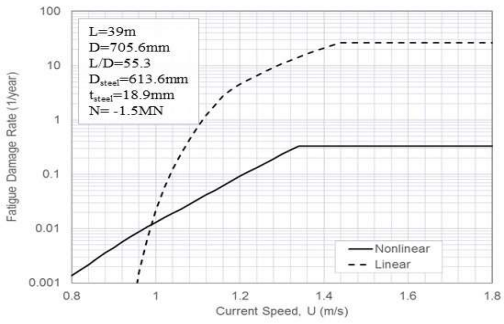
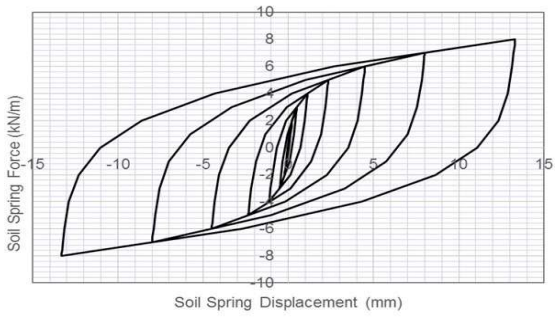
Spans in subsea pipelines are created not only due to pipelay on an uneven seabed but also due to scour. They can lead to Vortex-Induced Vibrations (VIV) of the spans and the associated fatigue damage. The current practice to assess such spans is based on linearization to capture the dynamic response by modal analysis, together with an empirical response functions which provides the modal response amplitude. Thus the effect of the local amplitude of VIV response where the pipe is supported by the soil on the effective soil stiffness and damping is not accounted for.

To address this, an existing algorithm to track solution branches in structural stability problems involving bifurcation buckling is used to determine the amplitude-dependent natural frequency, mode shape and damping ratio for the in-line response of an pipeline span. This has a strong influence on the fatigue damage rate, as shown in the figure below.

Pluck tests on spans of an operating pipeline confirm the amplitude-dependent effect of soil nonlinearity and inelasticity on the natural frequency and damping ratio. In these, the pipe motion is recorded with accelerometers in a setup developed by UWA and DOF Subsea that could be clamped onto the pipeline, before it is plucked by pulling with the ROV until a weak link between the ROV and the pipeline breaks.

Advantages of strakes instead of intermediate supports to suppress VIV will also be mentioned, and supported by an assessment method for partially strake-covered pipeline span that essentially combines riser and pipeline assessment methods to remain consistent with established practice for pipelines while applying the energy balance methods used for risers.





Bio: Ralf Peek is an independent consultant, working primarily on pipeline assessments including structural reliability assessment (SRA), supported by a continuous improvement effort on the tools for such assessments. Formerly he worked at Shell where he was the Principal Technical Expert for pipeline integrity. He is the inventor of the ZRB method to trigger lateral buckles in pipelines, and the pipe-clamping mattress.

Many others also contributed to the work that will be presented.

Thursday. 17th September 2020
4:00pm - 5.00pm (AWST)

This Zoom event is by invitation only as space is limited.
RSVP Kath Lundy – katherine.lundy@uwa.edu.au

Shell Chair in Offshore Engineering

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