An Engineering Approach to VIV for Riser Interference

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ABSTRACT

The increase in the water depth of the field developments has prompted riser designers to evaluate the impact of riser interference in congested areas. Measurements made in 2006 have indicated the validity of the Blevins model of estimating the drag and lift on the downstream cylinder in the wake of an upstream fixed cylinder. New measurements performed in 2007 showed that the wake was expanded and the force on the downstream cylinder changed when the upstream cylinder was undergoing Vortex-Induced Vibration (VIV), requiring a fresh look and a new measurement campaign in 2008. This measurement campaign was conducted at a wide range of Reynolds number from 35 000 to 140 000.

The domain of validity of the observed widening of the wake has been assessed in term of Reynolds number and extent downstream. A model by generalized asymptotic solutions is applied to the wake force to describe some of the features of the VIV wake with reasonable accuracy.

The paper describes the experimental measurements, the features of the wake, the proposed wake model, and its range of validity based on comparison of the measurements and model prediction.

This work has practical implications in the spacing design of parallel riser and jumper systems in deepwater applications. It allows the evaluation of the proposed riser and jumper systems in congested areas.

KEY WORDS

Drag Force, FPSO, HRT, Lift Force, Riser Wake Interference, VIV.

INTRODUCTION

Bundle Hybrid Riser Towers (HRT) have been installed in deepwater in West Africa (Total Girassol, BP Angola Greater Plutonio). In both cases the jumpers were attached along the freeboard of the Floating Production Storage and Offloading unit (FPSO) as shown on Fig.1. The spacing between the jumpers is at about 4 to 5m.

Besides being field proven, Hybrid Riser Towers offer the below specific advantages:
- Large diameter risers can be accommodated
- In-place riser fatigue is low (which can be a significant driver in sour service conditions)
- Field layout is simplified and allows future expansion
- Demanding flow assurance requirements can be met
- Riser hang-off loads on the Floating Production Unit are drastically reduced

Fig. 1: Riser Tower Systems installed at West Africa