Global Analysis of Soil and Riser Coupling Interaction Using a Degradation Soil Model

Edgar Stonyo Bernardo Micolo[1,4], Fabrício Nogueira Corrêa[2,4], Breno Pinheiro Jacob[3,4]

[1]edgar.micolo@lamcso.coppe.ufrj.br

[2]fabricio@lamcso.coppe.ufrj.br

[3]breno@lamcso.coppe.ufrj.br

[4]*LAMCSO – Laboratório de Métodos Computacionais e Sistemas Offshore, PEC/COPPE/UFRJ – Programa de Engenharia Civil do Instituto Alberto Luiz Coimbra de Pós – Graduação e Pesquisa de Engenharia da Universidade Federal do Rio de Janeiro, Avenida Pedro Calmon, Cidade Universitária, Ilha do Fundão, 21941-596- Rio de Janeiro, Brasil.*

ABSTRACT

In offshore Oil and Gas industry as water depth increase the prediction of the loads acting in a riser became more complex, this because three kind unestablished problems in a steel catenary riser (SCR) (a) a coupled the riser with the FPS (b) vibration induced by vortex, and (c) the interaction the riser with seabed. Normally, those problems are treated separately in spite of intensity coupling behavior in each other. A despite of soil and riser interaction, TDP is a hot spot where the interaction is intense, so a good prediction perform a better assessment of SCR fatigue life. In such way, different type of soil has been study since the linear to nonlinear spring. Nonetheless, linear spring is not able to represent the real soil behavior, thus researches focus on P-y curves based in pipe-soil experimental results and two model became widely studied: the non-degradation and degradation model. The non-degradation model already has application in some projects, but degradation model is not. Degradation model is based on soil plastic deformation under cyclic load of the riser and has others features as well soil water mixed, erosion and soil consolidation, which can lead the riser separation underneath soil and trench formation beneath riser. This characteristic can unestablished the model but recently researchers has some success to establish this model.   So, the propose of this work is to perform the soil-riser interaction using a degradation model, proposed by Zargar et al 2017, on in-house program SITUA-Prosim using a strong coupling formulation in time domain, where the FPS is rigid body with 6 DOF and the riser is modeled by finite elements. So, the main goal in this work is to provide more accurate soil effect on dynamic riser behavior taking in account coupled models of offshore system.

Keyword: Soil-Riser Interaction, Degradation Soil Model, Couple Solution.