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Numerical and experimental investigation on the global performance of a novel design of a Low Motion FPSO

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Abstract. Floating Production Storage and Offloading (FPSO) units have the advantages of their ability to provide storage and offloading capabilities which are not available in other types of floating production systems. In addition, FPSOs also provide a large deck area and substantial topsides payload capacity. They are in use in a variety of water depths and environments around the world. It is a good solution for offshore oil and gas development in fields where there is lack of an export pipeline system to shore. However due to their inherently high motions in waves, they are limited in the types of risers they can host. The Low Motion FPSO (LM-FPSO) is a novel design that is developed to maintain the advantages of the conventional FPSOs while offering significantly lower motion responses. The LM-FPSO design generally consists of a box-shape hull with large storage capacity, a free-hanging solid ballast tank (SBT) located certain distance below the hull keel, a few groups of tendons arranged to connect the SBT to the hull, a mooring system for station keeping, and a riser system. The addition of SBT to the floater results in a significant increase in heave, roll and pitch natural periods, mainly through the mass and added mass of the SBT, which significantly reduces motions in the wave frequency range. Model tests were performed at the Korea Research Institute of Ships & Ocean Engineering (KRISO) in the fall of 2016. An analytical model of the basin model (MOM) was created in Orcaflex and calibrated against the basin-model. Good agreement is achieved between global performance results from MOM's predictions and basin model measurements. The model test measurements have further verified the superior motion response of LM-FPSO. In this paper, numerical results are presented to demonstrate the comparison and correlation of the MOM results with model test measurements. The verification of the superior motion response through model test measurements is also presented in this paper.

Keywords: wave basin test; Low Motion FPSO (LM-FPSO); global performance analysis

1. Introduction

Floating Production Storage and Offloading (FPSO) platforms provide crude oil storage, have plenty of deck area for topside and facilities, and are suitable for large topside payload, variety of

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