

A Blind Comparative Study of Focused Wave Interactions with a Fixed FPSO-like Structure (CCP-WSI Blind Test Series 1)

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Results from Blind Test Series 1, part of the Collaborative Computational Project in Wave Structure Interaction (CCP-WSI), are presented. Participants, with a range of numerical methods, simulate blindly the interaction between a fixed structure and focused waves ranging in steepness and direction. Numerical results are compared against corresponding physical data. The predictive capability of each method is assessed based on pressure and runup measurements. In general, all methods perform well in the cases considered; however, there is notable variation in the results (even between similar methods). Recommendations are made for appropriate considerations and analysis in future comparative studies.

INTRODUCTION

Numerical modelling has become an important process in the design of offshore structures and a vast number of tools have been developed as a consequence. The complete range of model fidelity is now available with the trade-off between computational efficiency and model complexity, i.e., the level of simplification made to the physics being solved, being a key driver when selecting a numerical tool for a particular application. Despite this, results from the 1st Collaborative Computational Project in Wave Structure Interaction (CCP-WSI) Focus Group Workshop demonstrate that there still remain considerable uncertainties in the required level of model fidelity when using numerical methods to simulate the interaction of waves with offshore structures (CCP-WSI, 2016). Some progress, towards selecting a tool, can be made ahead of time by considering key parameters of the problem, such as the wave and geometric nonlinearity and corresponding dimensionless numbers. However, to promote the routine practical application of numerical tools, particularly high-fidelity methods, in industrial development processes, greater confidence in their applicability needs to be established.

The CCP-WSI Blind Test Workshops were devised to improve the understanding of this issue and provide information for future development of numerical modelling standards. These workshops bring together numerical modellers from the wave–structure interaction (WSI) community and assess the numerical codes currently in use by inviting participants to simulate a series of specific

problems covering a range of relevant complexities, without prior access to the physical measurements. The proposed test cases in each Blind Test Series are introduced at an introductory event, providing a forum for participants to discuss the cases and the validation process. All required information to reproduce a set of bespoke physical validation experiments is then made available in a release event. Participants are then invited to submit simulation results for each case before a showcase event, in which the results from the test and present recommendations are shared with the community.

Comparative studies over a broad range of test cases are essential in gaining a parametric understanding of the required model fidelity. The type of blind comparison discussed here is particularly valuable in assessing the various strengths of numerical methods, as participants cannot manipulate their results in light of the physical measurements. This encourages the observation of best practices and offers a true representation of the capabilities of the method, allowing for development of standard practices and certification of numerical models (crucial in encouraging significant uptake and mitigating the risk of their use by industry). Despite this, the process of performing a comparative study, with potentially vast numbers of multivariant data submissions, is challenging (Hong et al., 2018), and established groups from similar fields (Larsson et al., 2014) still rely on qualitative comparisons of specific cases, with few offering a parametric understanding of predictive capability or consistent analysis methods between cases. Therefore, producing evidence for best practices in comparative studies and making recommendations relevant to future parametric certification protocols are still valuable.

CCP-WSI Blind Test Workshops – Series 1

There will be a number of series within the CCP-WSI Blind Test Workshops; Series 1 (the subject of this paper) was held in conjunction with the International Society of Offshore and Polar

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Received September 25, 2018; revised manuscript received by the editors December 6, 2018. The original version was submitted directly to the Journal.

KEY WORDS: Code comparison, numerical validation, CFD, FNPT, PIC, hybrid codes, focused waves, range of steepness, range of incident wave angle, FPSO, run-up and pressure on bow.