Structural analysis of the gripper connection during Monopile installation

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ABSTRACT

In this study initial hammering(shallow penetration) process with a heavy Lifting Vessel(HLV) and dynamic response of the coupled HLV-MP system has been presented. Modelling of the MP-gripper system is also discussed elaborately. Later from the dynamic response of the gripper, local analysis of the gripper device is done by Abaqus. A simplified model of the gripper system is created and the effects of MP (Monopile) welding seam parameter, MP speed, roller size, boundary condition , spring stiffness on the critical component of the gripper system are presented.

OBJECTIVES

-Study the MP initial hammering process

-Perform global dynamic analysis

-Finite element analysis of the (FEA) of the MP-gripper connection.

-Conduct sensitivity study of the key modelling parameters

-Identify potential failure modes of the MP-gripper connection.

METHODS

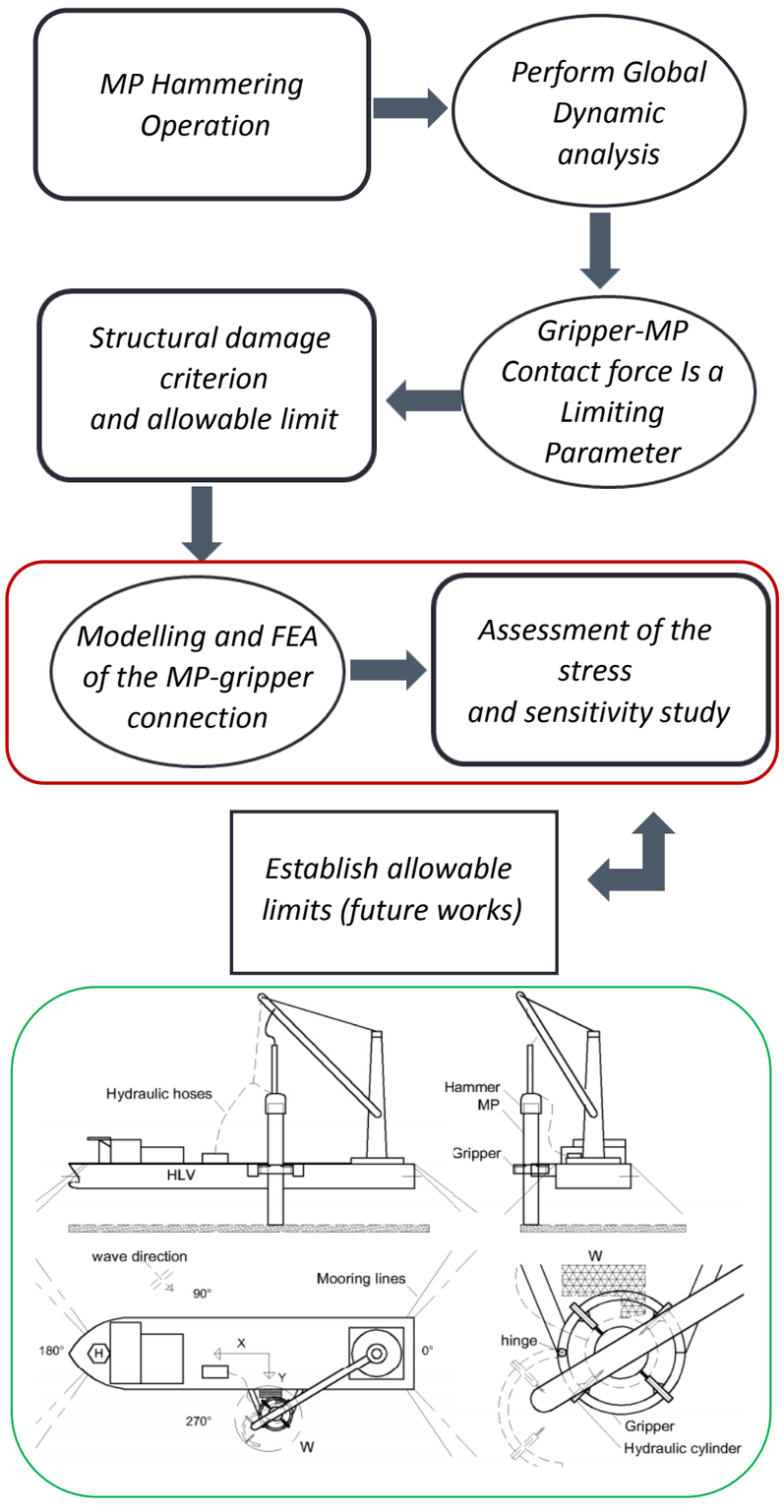
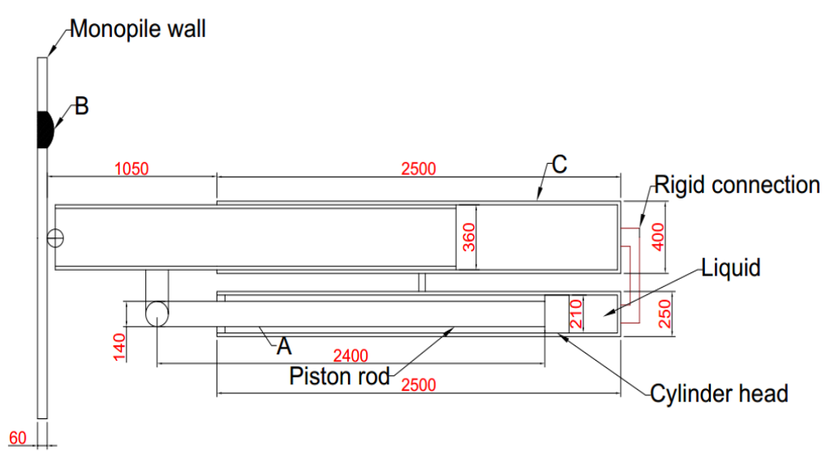
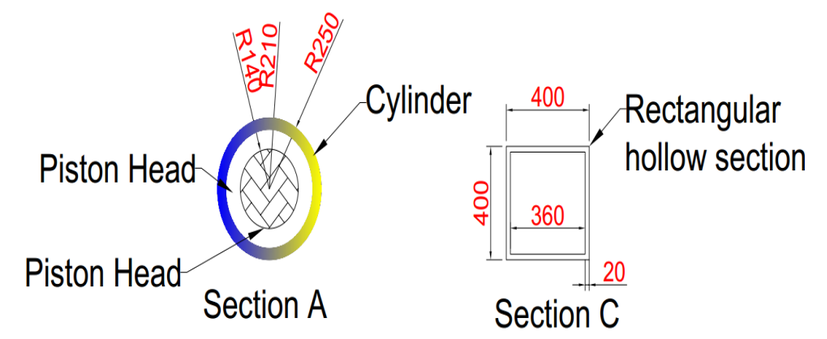
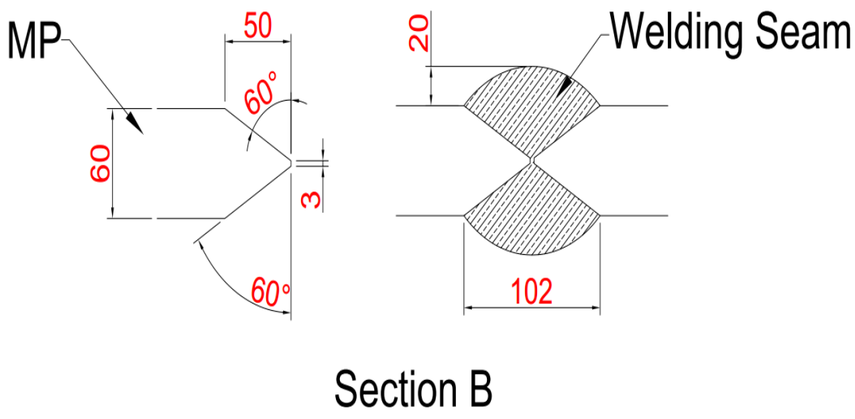


Figure 1: MP hammering procedure(Lin Li)

MP-GRIPPER MODELLING







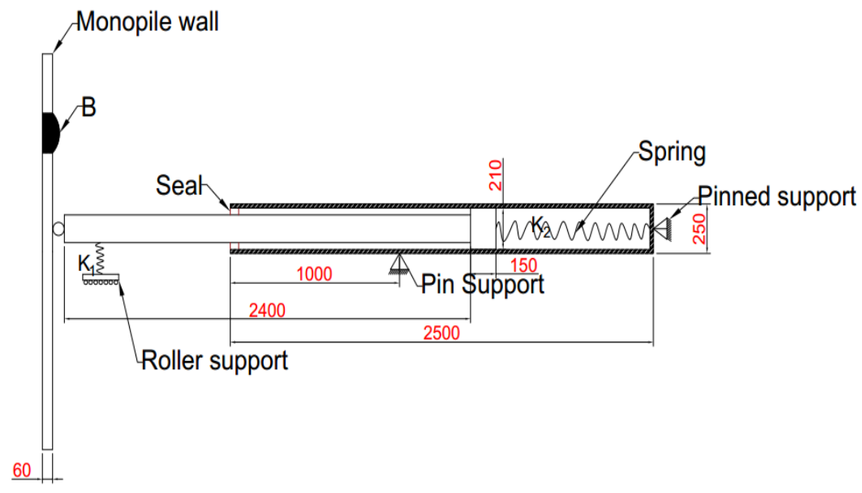


Figure 2: First figure shows a real picture of the MP-gripper system(Lin li), second shows the details of the typical gripper device, next two figure show the local details and final figure represents the simplified model for Abaqus analysis.

RESULTS

T_p= 5 s, Dir=150 degree, H_s= 1.5 m

Figure 3: Response spectra of gripper

Global dynamic analysis was conducted by SIMO and Figure 3 shows the dynamic response of the gripper force and it was found that the gripper force is a limiting parameter.

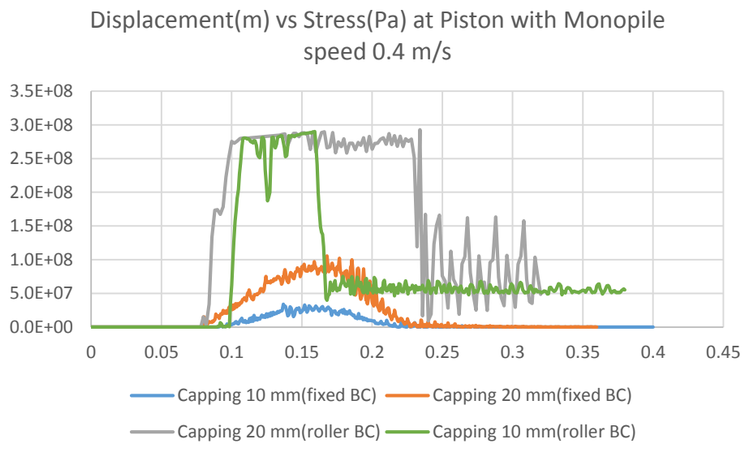


Figure 3: First figure shows the effect of MP speed, second one shows the effect of welding seam height(capping) of the MP and the boundary condition of the spring K1 on the stress concentration at the piston rod.

CONCLUSIONS & REFERENCE

-The speed of the Monopile does not affect the result of the analysis that much

-It was found that lateral loads caused by seam welds are very important.

-Geometry of the welding seam directly affect the stress concentration.

-Decreasing roller size increases stress concentration.

- Governing parameter for roller stress concentration is the hydraulic system and for the seal, it is the stiffness of the square arm.

Reference:

1. *Assessment of allowable sea states during installation of OWT monopiles with shallow penetration in the seabed by Lin Li, W.G.Acero,Zhen Gao, Torgeir Moan.*
2. *Abaqus User manual.*