The structural behaviour of 66 kV submarine cable under sea waves and currents effect

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Abstract. Due to the energy changes, the submarine cross-linked three-core polyethylene power cable has been increasingly used, and its capacities had more than 66 kV. Due to the disadvantages using J-tube, new type of submarine was needed. Submarine cable system without using J-tube was consisted of three-core submarine cable and protective equipment. In the present study, the structural behaviour of 66 kV three-core submarine cable was investigated under various marine environment, mainly sea load of waves and currents effect.

Introduction

Due to the energy changes, the submarine cross-linked three-core polyethylene power cable has been increasingly used, and its capacities had more than 66 kV [1, 2]. The submarine cable is the hub connected to the land-based power grid, and the research on the submarine cable transmission technology is crucial to the better engineering applications [2]. Fixed type inner network submarine cables are installed with pre-installed on the substructure metal J-tube. In this type, submarine cables must be operated with the condition that they do not touch the seabed. Therefore, the work-space and environment is limited. In these trends, new type of submarine was needed without using J-tube. This type of submarine cable system without using J-tube was consisted of lots of protective equipment such as UP-pipe, bend restrictor, piggy back clamp, permanent clamp, and flexible protection tube. Among the protection equipment, permanent clamp and piggy back clamp was crucial components to the protection of submarine cable. In the present study, the structural behaviour of 66 kV three-core submarine cable was investigated under various marine environment, mainly sea load of waves and currents effect. The submarine cable was modelled with refined finite element model (FEM) using the commercial computational FEM software ANSYS (ANSYS, version 22). The numerical calculation of integration of the motion equations was conducted with the method of wave-structure interaction simulated by the numerical software ANSYS/AQWA.

Results and discussion

The previously investigated material properties of 66 kV three-core submarine cable and protective equipment of flexible protection tube was adopted. The sea load of waves and currents, and the distance between permanent clamp and piggy back clamp was considered with the previously examined environmental database. When the sea load of waves and currents was applied, the maximum total deformation was obtained in the middle of the piggy back clamps, and different values was shown with each applied load as shown in Fig. 1. The total deformation was ranged from 2.01 mm to 14.98 mm, and the stress values were ranged from 8.9 MPa to 54.43 MPa.

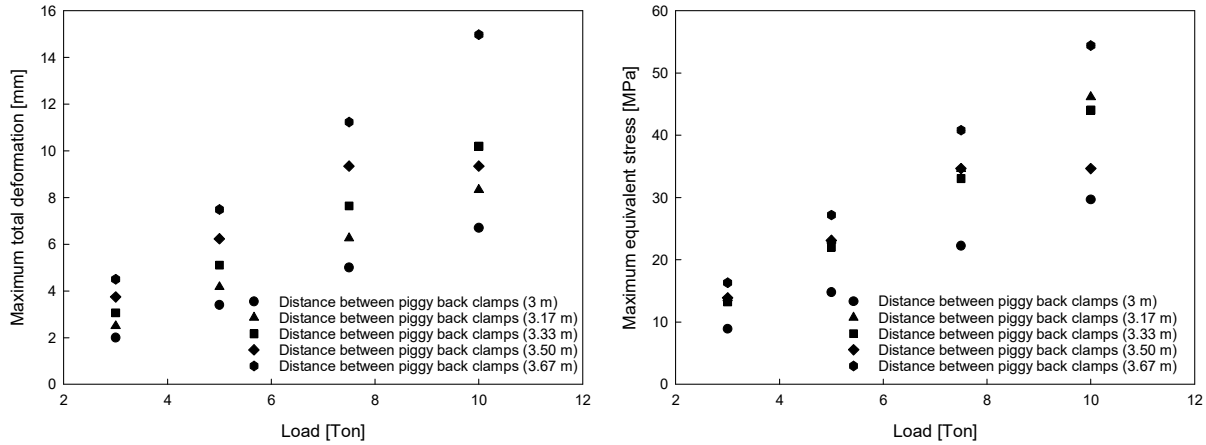

Figure 1: Total deformation and maximum equivalent stress of 66 kV three-core submarine cable.

References

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