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Influence of Different Foundation Models on the Dynamic Response of Jacket Offshore Wind Turbines with Local Joint Flexibility

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ABSTRACT

This study assessed the influence of three joint elements and four foundation models on the dynamic response of jacket offshore wind turbines, specifically focusing on natural frequency, structural displacement, and member stress. Moreover, parametric studies were performed to evaluate the sensitivity of different foundation models to changes in soil properties, pile diameter–thickness ratios and pile embedded depths. The results indicate that the rigid and center-to-center models significantly overestimate joint stiffness compared to the local joint flexibility model. Using the distributed nonlinear spring model as a reference, both the fixed foundation and equivalent coupled-spring models overestimate foundation stiffness, whereas the apparent fixity length model underestimates it. Additionally, the distributed nonlinear spring model shows notable sensitivity to the pile diameter–thickness ratio and pile embedded depth, while the apparent fixity length model exhibits larger sensitivity to soil properties and the pile diameter–thickness ratio. Overall, this study developed an advanced jacket model that incorporates both joint and foundation flexibility, significantly improving the accuracy for the dynamic response prediction of offshore structures under combined wind–wave–current loads.

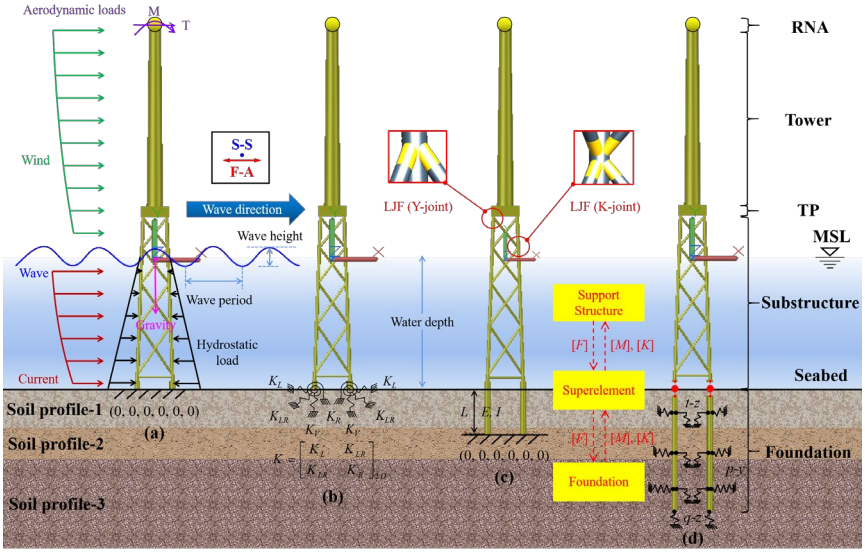

Fig. 1. FE model with four foundation models: (a) FF, (b) ECS, (c) AFL, and (d) DNS models

REFERENCES

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