

## Large Amplitude Free Vibration of a Very Sag Marine Cable

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**Abstract :** This paper focuses on a variational formulation of large amplitude free vibration behavior of a very sag marine cable. In the static equilibrium state, the marine cable has a very large sag configuration. In the motion state, the marine cable is assumed to vibrate in in-plane motion with large amplitude from the static equilibrium position. The total virtual work-energy of the marine cable at the dynamic state is formulated which involves the virtual strain energy due to axial deformation, the virtual work done by effective weight, and the inertia forces. The equations of motion for the large amplitude free vibration of marine cable are obtained by taking into account the difference between the Euler's equation in the static state and the displaced state. Based on the Galerkin finite element procedure, the linear and nonlinear stiffness matrices, and mass matrices of the marine cable are obtained and the eigenvalue problem is solved. The natural frequency spectrum and the large amplitude free vibration behavior of marine cable are presented.

**Keywords :** axial deformation, free vibration, Galerkin finite element method, large amplitude, variational method

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