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”PACO#3 - Nonlinear passive control of galloping of overhead transmission lines: design and numerical verifications”

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In the field of power delivery, the vibration of overhead conductors affects the sustainability of transmission lines. The passive control of galloping of conductors is the subject of this study. Galloping oscillations are caused by ice accretion on a cable that creates an aerodynamic instability. The consequences of galloping on transmission lines are electrical outages, fatigue failure of cables, and the impacts between cables. The study focuses on the nonlinear passive control of a single conductor. The use of a nonlinear absorber called as nonlinear energy sink (NES) with a piecewise linear restoring forcing function for galloping mitigation on a single span of a suspended cable is proposed. An analytical model of a single conductor span coupled to a NES is developed. The fluid-structure interaction, i.e. the interactions of the wind and the ice-accreted cable, is modeled by a parametric excitation supposing the quasi-steady theory. A complexification technique accompanied by the time multiple scale method is used to determine the slow and fast dynamics of the system. The bifurcation diagrams are analytically determined and compared with results obtained from the numerical integration of the governing equations of the system. The system with harmonic excitation is modeled using the finite element (FE) method with the software Code_Aster. An equivalence between harmonic and parametric excitation is addressed to compare the results from the FE model and the analytical developments. The influence of the parameters of the nonlinear absorber: clearance, stiffness, and damping coefficient on galloping mitigation is studied.

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