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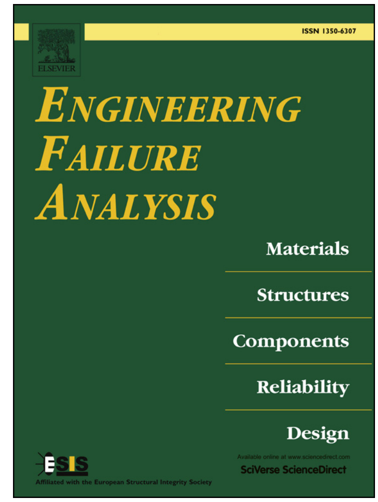

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ABSTRACT: A full scale transmission line section of three continuous spans was established. With the consideration of the equivalent mass of the accreted ice, steel cables are used to simulate the iced conductors. For different types of conductors and ice thickness, broken conductor experiments were carried out. Under different broken cases, time histories of the tensions and displacements at the middle of conductor spans were measured. The first order damping coefficients of the line section for different broken cases were calculated. The Fourier transform of the experimental time history of the conductor tensions was completed. The dynamic impact factors of the conductor tensions were determined. The experimental results show that the impact effect is more significant for the location nearer to the break point. The dynamic impact factors decrease with the increase of the ice thickness, and the impact factors of conductors without accreted ice are much higher than those of conductors with accreted ice. With the increase of the ice thickness, the initial tensions before break as well as the ratios of the residual static tensions to the initial tensions increase. Nearly all the first peak tensions are close to the initial tensions for the broken cases with accreted ice. The damping coefficients determined by the experimental identification were applied to the finite element analysis (FEA) model. The stiffness of the accreted ice as well as the contact effect between the conductors and the ground are considered in the FEA model. The numerical simulations were performed for different broken cases. Both the residual static tensions and the first peak tensions by the numerical simulations were well agreed with the experimental values. The maximum differences are 5.6% and 12.9% respectively.

Kewwords: Broken conductors; Prototype experiment; Damping identification; Dynamic tension; Impact factor

1. Introduction

Accreted ice, galloping and strong wind can cause break of conductors or ground wires in transmission lines. In the broken process, high longitudinal unbalanced tension will be produced, which can cause transient impact on transmission towers. The stresses and displacements of transmission towers increase significantly. The tower will be collapsed and even a major collapse with cascading effect happens. Many Studies have been focused on load values and dynamic responses of the tower-line system by numerical and experimental methods in recent years.

The numerical studies are mainly by two methods. The first is the static calculating program based on the equilibrium conductor length method [1-2], and the impact effect cannot be considered. The second is the dynamic analysis by implicit or explicit method [3-17], the dynamic responses from the broken conductors can be calculated by nonlinear transient analysis. Alan B. Peabody and G.McClure [11] have modelled the EPRI-Wisconsin line with broken conductors using ADINA. It shows that the first peaks of the insulator tensions were modelled accurately in time and magnitude. The second peaks were modelled accurately in time. However, the magnitudes were larger than those measured during the tests. A damping ratio of 0.5% was used in this study.