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Critical longitudinal forces in conductors under tornadoes

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ABSTRACT

Transmission lines structural failures caused by tornadoes have been observed in multiple countries around the globe. When tornado occurs in the vicinity of a transmission tower, an uneven wind velocity distribution will develop along the conductor spans adjacent to this tower. This generates differences of tension force in the adjacent spans. The longitudinal force caused by these differences is believed to be one of the reasons of towers' failure under tornadoes. Due to the localized nature of tornado, the generated longitudinal force depends on the position of tornadoes. The geometric and material parameters of conductors will also influence this force. The objective of this study is to provide an accurate load case that can simulate the critical tornado configuration for transmission line, while taking into account the key conductor parameters. The study focuses on F2 tornado since this magnitude covers the majority of observed tornadoes. The numerical model used in this study, which combines the wind field with an a non linear analytical technique for solving the conductors, was previously developed and validated by the authors' research group. A study is first conducted to identigy the tornado position that generates the largest longitudinal reaction. Then based on the critical position, a parametric study is conducted on two different transmission line system to access the influence of conductor parameters on the longitudinal forces.

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