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CABLE TENSION ESTIMATION USING ARTIFICIAL NEURAL NETWORKS

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Abstract. The accurate estimation of tension forces is crucial for ensuring the safety, reliability, and optimal performance of slender guyed telecommunication masts. For this matter, a wide variety of closed mathematical expressions are available on the literature and design standards, which allow to estimate the tension force based on the natural frequencies of the cables. However, the guy configurations with insulators along their length -which are very usual in AM radio masts- constitute a particular challenge, given that the application of available formulas on these components, could lead to considerable errors. To address this, an approach is presented in this article for the identification of the tension force in guy configurations with insulators along their length. For this purpose, a mathematical model that captures the geometric nonlinearity of the curved configuration of guy wires is firstly stated. The dynamic and frequency responses are simulated by means of a numerical model based on the Finite Element Method. On that basis, a Bayesian Neural Networks is proposed as inverse model to estimate tension forces based on the natural frequencies of the guy wires. Thus, it is possible to obtain not only an estimated value for the tension, but also a probability distribution that reflects the confidence in that estimation. The training of the neural networks is based on extensive numerical simulations. The identification scheme is validated using real-scale cables with insulators. The results and insights presented provide valuable guidance for future applications and advancements in this field.

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