Vibration attenuation on Tubular Telecommunications Towers using Non-Linear Energy Sink

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Abstract

Telecommunication towers are a crucial component of modern communication infrastructure, facilitating the transmission and reception of signals for various communication forms such as mobile phones, radio, and television. However, the airflow around these structures may generate vortex shedding, which can lead to excessive vibrations, resulting in structural fatigue, reducing the tower's lifespan, and compromising its integrity
One commonly used solution by various manufacturers is the Tuned Liquid Dampers (TLDs) to mitigate vibrations. Tuned Liquid dampers uses a liquid confined in a container, to control vibrations of a primary structure, by dissipating the energy through the fluid damping inside the container. This damper offers the advantage of being cost effective. However, these solutions have several drawbacks: they are effective only at a specific frequency, involve complexity in reservoir sizing, and are highly dependent on the choice of fluid, among others.
Our study proposes the use of Nonlinear Energy Sinks (NES) as an alternative to TLDs. NES take advantage of nonlinearities to control vibrations across a broad frequency range while offering the benefits of simplicity in analysis and design compared to TLDs. This work focused on the application of this approach to control vibrations in steel tubular telecommunication towers. The simulations show promising results, demonstrating that this solution can effectively meet the requirements for vibration control in the studied structures.

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