Nonlinear Swaying of Y Branch Structure

Poster

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The way trees move in response to wind is influenced by both their structure, especially the branches and the nonlinearity in the restoring force. The ref. [1] is the first instance of using an anharmonic oscillator model to understand the swaying of trees. The model consisted of a single segment with nonlinear restoring force and and a truncated gravitational destabilizing force. Kashyap and Kolwankar [2, 3] extended the model by considering several segments and also the full gravitational term in order to allow for the large oscillations in the stormy conditions. In this work we consider the Y-shaped branch. This structure is an important fundamental unit of a tree structure. In this study, we focus on understanding how such Y-branch model sways under the transverse and lonitudenal forcing conditions. We have developed mathematical equations to describe the motion and analysed their behaviour under different wind patterns, different parameter values. We study the nonlinear phenomena arising from the motion of this Y-branch. Our work not only throws light on how trees maintain or lose stability under wind forces but also provides a foundation for studying their swaying in real-world settings. This study has broader implications for protecting trees against wind damage and for applications in fields like structural dynamics and computer animation.

References

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