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Comparative study on the buckling properties of Palmyra and Coconut trees

Harsha Kumara, S.B.R.[1*] and Kandasamy. K.[1]

Department of Physics, University of Jaffna, Jaffna, Sri Lanka

In this study, a simple device was designed and developed to to measure the critical load to produce buckling of large wooden samples. Using this device, the required critical load to produce buckling was analyzed for Coconut and Palmyra trees. The actual load acting on the selected Coconut trunk was measured as 1059.48 N and the estimated critical load is 1536.72 N. On the other hand, the critical load to bend the Palmyra trunk was determined as 12734.10 N, while the actual load acting on that Palmyra trunk was measured as just 2656.55 N. The ratio between the actual load and critical load for bending in coconut tree is about 1:1.5 while the same ratio is about 1:5 in Palmyra tree. The ratios from the study gives a reason for this observed buckled shape of Coconut tree and Palmyra trees grown in the nature. Further, the same device was used to measure the Young's modulus of the wooden trunks. The average values for the Young's modulus of the selected Coconut and Palmyra trunks were determined as 8.01×10^8 ($\pm$ 2.47 x10^8) Nm^{-2} and 22.16×10^8 ($\pm$ 3.90 x10^8) Nm^{-2} respectively. Highest young's modulus and buckling coefficient of the Palmyra tree made it as the most suitable material for construction work.

Keywords: Critical load, Young's modulus, Buckling nature, Euler's theory

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**Corresponding Author: rohanharsha92@gmail.com*