Twisted Rope

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Abstract

Twisting a piece of string at some point causes the string to become buckled. Further twisting that piece of string will eventually cause it to coil around itself forming a Helix-Like structure. In this research, we investigated the formation of the first loop , (and measured the distance of the two ends of the rope towards each other (D) and the rotation angle (R). Displacements are controlled and the corresponding forces and moments remain passive. Several plastic ropes with different lengths are used. One of the ends of the ropes was fixed and the other end was rotated. Once the first loop occurred, the distance between the two ends of the ropes was measured. The Experiment's Error was nearly 10% and we only surveyed the mathematical model in two dimensions. The gravity effect is neglected. We concluded that, by using the mathematical model, we can understand when a loop occurs with regards to specific (R) s and (D)s.

Introduction

Twisting a piece of string at some point causes the string to become buckled. Further twisting that piece of string will eventually cause it to coil around itself forming a Helix-Like structure. This is something that all of us have observed at some point in our real life. Born , carried out some elegant large deflection bending experiments by hanging weights on the end of a rod (i.e., dead loading)[1]. Yabuta,using an energy method, assumes an initial helical deformation (which is Love's solution[3]) and obtained the Greenhill,formula for the onset of looping, which in fact describes the primary bifurcation for a rod with zero bending moments at its ends. Modeling the loop as a circle, he also derived a formula for the point at which it reopens (i.e., pop-out), which he compared with his experimental results[2]. Goss and coworkers by using varied R (Rotation) and fixed D (slack) ,found that if a loop forms in a rod, then unwinding the twist may instigate a dynamic jump as the rod pops out of self-contact[4]. The importance of this phenomenon is comprehended in several aspects of science. For example: In **"engineering"** , Marine cables under low tension and torsion on the sea floor undergo a buckling process during which tensional energy is converted to flexural energy . The cable becomes highly contorted with loops and tangles, this can permanently damage the cable. In **"textile industry"**, and the study of multi-filament structures such as yarns is interesting.