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Force distribution of a string under tension

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In this work we have attempted to study the force variation on the neck of a hanging person using a model calculation with experimental verification. First, the variation of the normal inward force of an arbitrary-shaped string under tension was formulated and it was found that the normal inward force $R(\theta)$ at a given point with angular coordinate θ, is equal to the product of the tension $T(\theta)$ and the curvature $\kappa(\theta)$ of that point. The inward force of a string that hangs a cylindrical object horizontally, was theoretically found to be minimum at the point opposite to the knot and to increase exponentially towards the knot from both sides. We were able to verify this result experimentally using a metal cylinder hanging horizontally. When the object hangs at an angle to the horizontal, the theory indicates that the variation of tension is the product of an exponential function and a function that depends on the inclination of the object such that where ϕ is the angle between the axis of the rod and the horizontal and α is the angle between the axis of the rod and the plane of the looped string.

$$T(\theta) = T_0 e^{-k(\alpha,\phi)\theta} f(\alpha,\theta)$$

The experimental results indicate that the variation of tension is primarily dominated by the exponential factor.

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