Uit: *TPT* **32**, 7, 1994, p. 327.

A Slinky Error

The article by French[1] entitled "The Suspended Slinky—A Problem in Static Equilibrium" contains an error. It states that the center of gravity of a suspended Slinky™ is located at the turn $n = N/2$. This is wrong because the Slinky does not stretch uniformly.

The center of gravity z_c can be found using the proportion $dm/M = dn/N$, where M is the total mass, N is the total number of turns, and dm is the mass of a differential piece with dn turns. The center of gravity (or mass) is given by

$$z_c = \frac{1}{M}\int z\,dm = \frac{1}{M}\int z_n \frac{M}{N}\,dn = \frac{1}{N}\int_0^N z_n\,dn$$

Here z_n is the expression in Eq. (4) of the article for the elevation above the bottom of the nth turn:

$$z_n = \frac{L_0}{N}n + \frac{(L - L_0)}{N^2}n^2$$

where L_0 is the unstretched length of the Slinky and L is its length when suspended.

The integration yields

$$z_c = \frac{L_0}{2} + \frac{L - L_0}{3}$$

whereas the stated value, obtained by evaluating z_n at $N/2$, is

$$z_{N/2} = \frac{L_0}{2} + \frac{L - L_0}{4} = z_c - \frac{L - L_0}{12}.$$

Reference

1. A.P. French, *Phys. Teach.* **32**, 244 (1994).

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French Responds

Professor Hosken is of course absolutely right. Mea culpa! I added that sentence about the center of mass, without thinking it through, because I was taken with the idea—unfortunately wrong—that one might be able to locate the center of mass in this case by just counting. I am indebted to Professor Hosken for pointing out this error.

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