

UOFSC, DEPARTMENT OF PHYSICS & ASTRONOMY.

Graduate student problem competition

DEC 15–DEC 22, 2023

All graduate students are eligible to participate.

To submit your solution, e-mail it to bazaliy@mailbox.sc.edu

Spring-and-ball triangle underwater

Three balls are connected by three identical springs. All balls have the same radii, so that each has a volume of 1 cm^3 . The masses of the balls are not the same: two balls have masses of 0.5 g , and the third one has a mass of 2 g . Springs have zero mass and are made of infinitely thin wire. They have unstrained lengths of 10 cm , and spring constants are 0.2 N/m for each spring.

The triangle is submerged in a water tank and floats in the water. It is observed that as a result the springs change their lengths. Find the new shape of the triangle, i.e., find its three angles. Assume that springs are connected to the balls by pivots, so the angle between two springs connected to a given ball can freely change. Your answer should provide the angles with the accuracy of 5% . You are allowed to find the angles numerically.

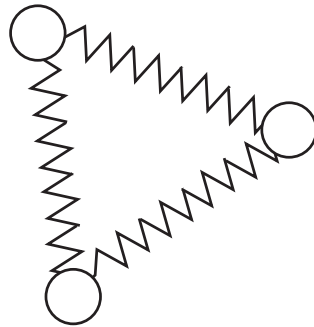


Figure 1: Three balls connected by identical springs, initial position