Torsion Balances

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2.1 Simple Torsion Balance

A torsion balance, in it's simplest incarnation, is just an extended body, called the "pendulum," suspended from a thin wire, the "torsion fiber." This forms a rotational spring-mass system which has two intrinsic parameter (ignoring loss terms): the moment of inertia, I, and the torsional spring constant, κ. The primary degree of freedom of this system is rotation of the pendulum around the axis of the fiber which we call torsion. See Section 4.1 for discussion of other degrees of freedom.

Due to historical reasons, the classical example of a torsion balance is a dumb-bell shaped pendulum suspended from a thin metal fiber, shown in Figure 1. The pendulum is formed by a massless rod with two equal mass "test masses" attached to each end. The torsion fiber is then attached to the rod at equal distance to each test mass. This provides a prototypical model of a torsion balance which we will analyze in detail.

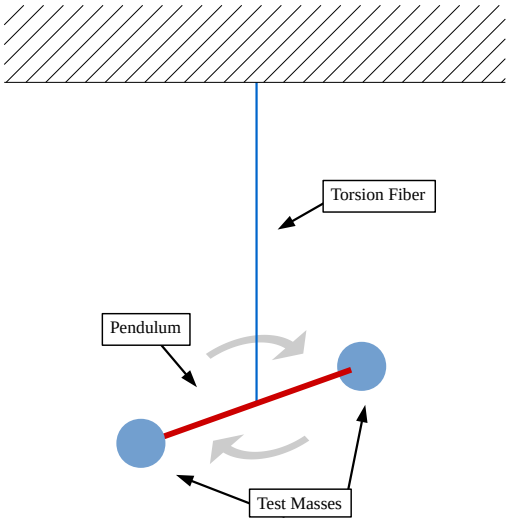

Figure 1: A simple torsion balance system.

Modern torsional balance apparatus typically have pendulums with more complex geometry and may have multiple suspension stages.

2.2 Equation of Motion

As mentioned in Section 2.1, the simple torsion balance is described with two primary parameter: the moment of inertia, I, which is determined by the pendulum geometry, and the torsional spring constant, κ, which is determined by the torsion fiber size and material.

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