The Coupled Pendulum

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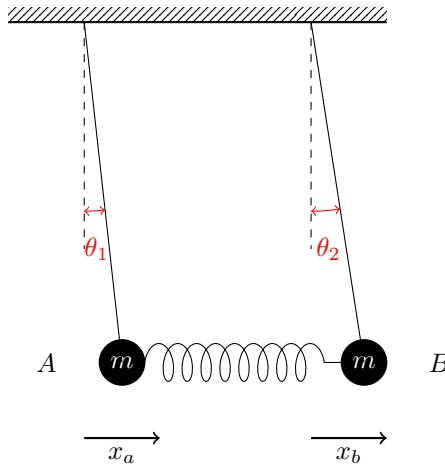
1   Two Coupled Pendulums

Figure 1: Two pendulums coupled by an ideal spring

Consider two pendulums of equal mass m, A and B, coupled by an ideal massless spring of spring constant k, as shown in Figure 1. The string may be considered sufficiently light so that it's mass may be neglected compared to the bobs. The equations of motion, considering small angle approximations $(\sin \theta \approx \theta, \ddot{y} \approx 0)$, for the two pendulums are

$$m\frac{d^2 x_a}{dt^2} = -mg\frac{x_a}{l} + k(x_b - x_a)$$
$$m\frac{d^2 x_b}{dt^2} = -mg\frac{x_b}{l} - k(x_b - x_a)$$