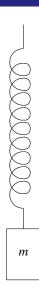
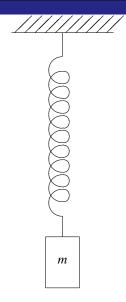
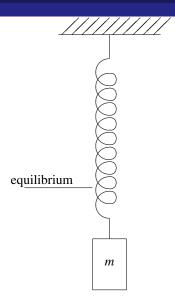
The Governing Equation(s) for a Spring-Mass-System

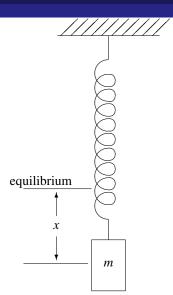
Bernd Schröder



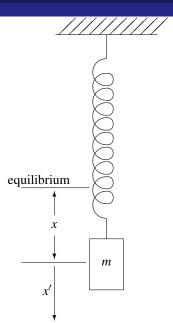




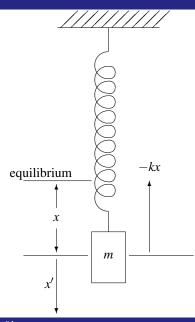




Outside Forces and No Friction



The Governing Equation(s) for a Spring-Mass-System



$$mx'' = -kx$$

$$mx'' = -kx$$

$$mx'' + kx = 0$$

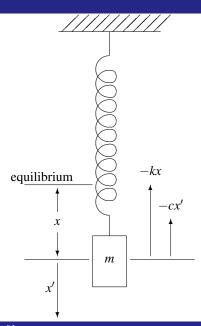
$$mx'' = -kx$$

$$mx'' + kx = 0$$

Free harmonic oscillator

$$mx'' = -kx$$

$$mx'' + kx = 0$$

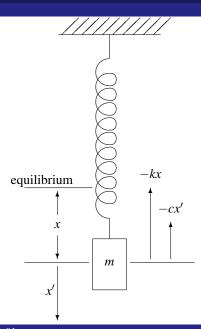


$$mx'' = -kx$$

$$mx'' + kx = 0$$

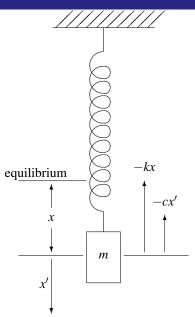
$$mx'' = -kx - cx'$$

$$mx'' + kx = 0$$



$$mx'' = -kx - cx'$$

$$mx'' + cx' + kx = 0$$



$$mx'' = -kx - cx'$$

$$mx'' + cx' + kx = 0$$

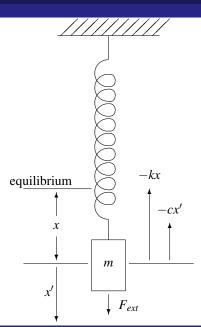
with damping

Free harmonic oscillator

Bernd Schröder Louisiana Tech University, College of Engineering and Science

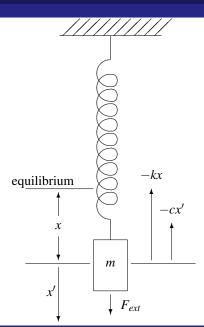
$$mx'' = -kx - cx'$$

$$mx'' + cx' + kx = 0$$



$$mx'' = -kx - cx'$$

$$mx'' + cx' + kx = 0$$

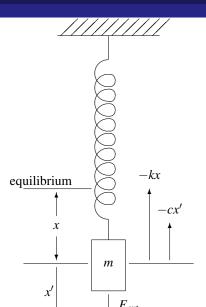


$$mx'' = -kx - cx' + F_{ext}$$

$$mx'' + cx' + kx = 0$$

$$mx'' = -kx - cx' + F_{ext}$$

$$mx'' + cx' + kx = F_{ext}$$



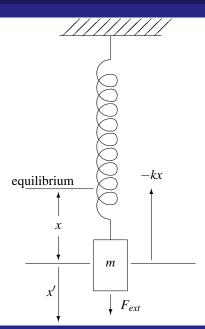
$$mx'' = -kx - cx' + F_{ext}$$

$$mx'' + cx' + kx = F_{ext}$$

Forced harmonic oscillator with damping

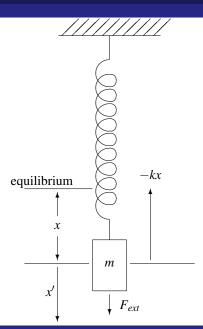
$$mx'' = -kx - cx' + F_{ext}$$

$$mx'' + cx' + kx = F_{ext}$$



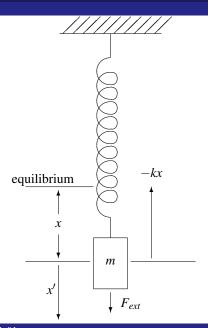
$$mx'' = -kx - cx' + F_{ext}$$

$$mx'' + cx' + kx = F_{ext}$$



$$mx'' = -kx + F_{ext}$$

$$mx'' + kx = F_{ext}$$



$$mx'' = -kx + F_{ext}$$

$$mx'' + kx = F_{ext}$$

Forced harmonic oscillator without damping