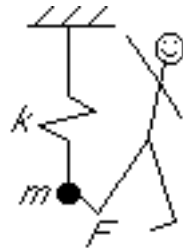# Introduction

Ordinary differential equations:

- Dynamical systems

$$m\ddot{x} + kx = F$$

$$\frac{\mathrm{d}}{\mathrm{d}t}\left(\frac{\partial L}{\partial \dot{q}_i}\right) - \frac{\partial L}{\partial q_i} = 0$$

- Fluid mechanics

- Chemical reactions

$$\frac{\mathrm{d}O_2}{\mathrm{d}t} = -k_1[O_2][H_2] - k_2[O_2][C] + \ldots$$

$$\frac{\mathrm{d}H_2}{\mathrm{d}t} = -2k_1[O_2][H_2] - k_3[H_2][C] + \ldots$$

- Economics

- Biology

- ...

Notations:

- Ordinary differential equations: one independent variable

- Partial differential equations: more independent variables

- Order: order of the highest derivative

- Degree: highest degree of the dependent variable

- Linear: first degree