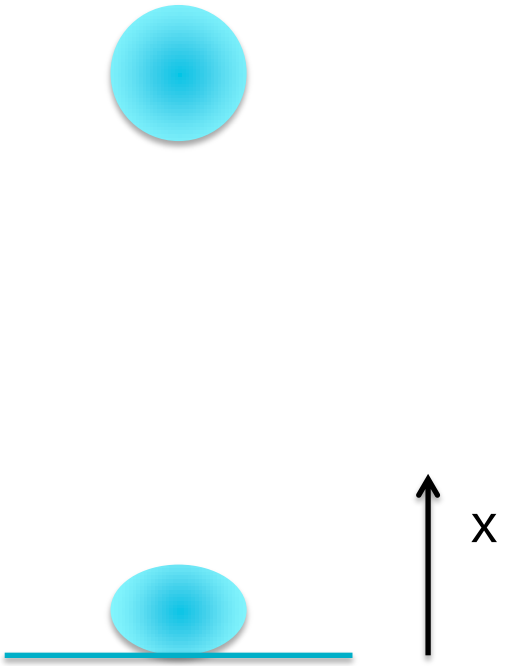
Solving Differential Equations
Free Falling Ball

Faculty of Technology and Bionics

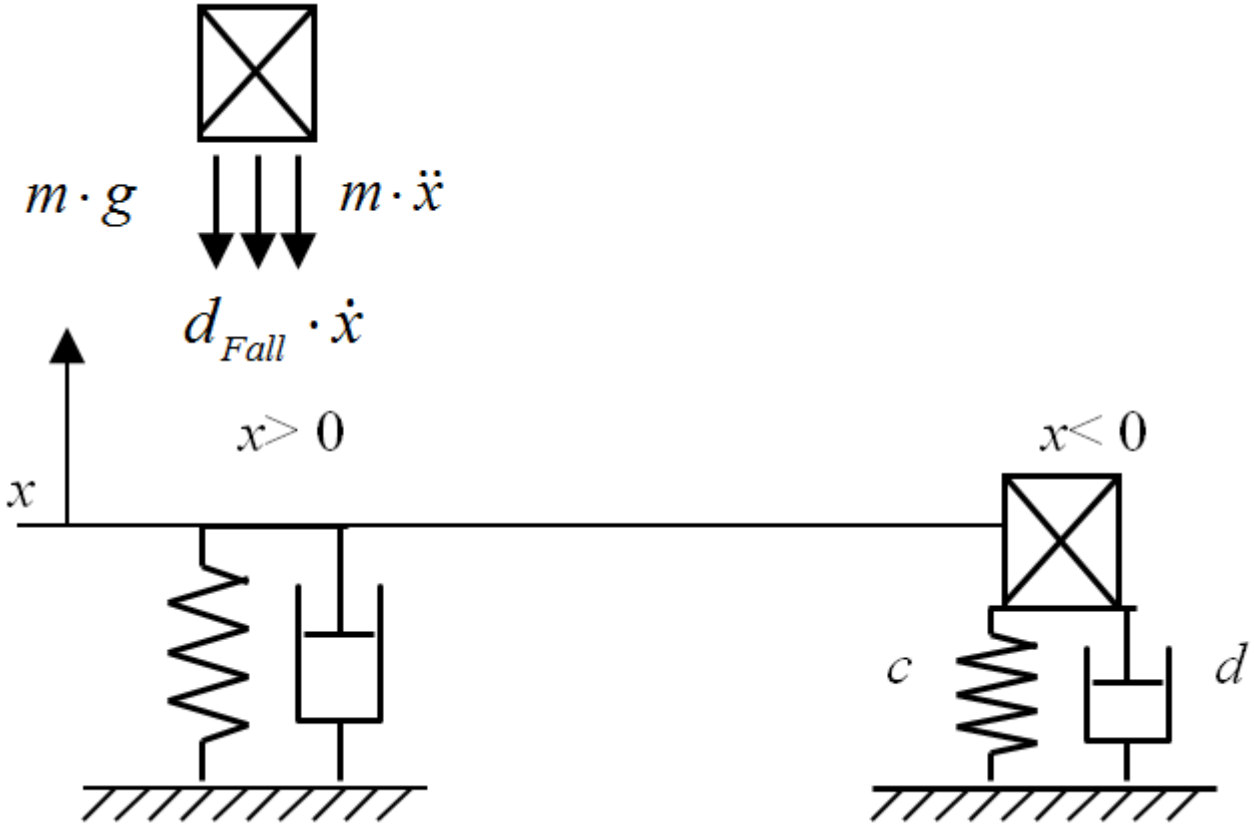
Free Falling Ball

The position of a free falling ball should be modeled. The collision to the ground is considered as elastic.



Free Falling Ball

Modeling during contact phase



Free Falling Ball

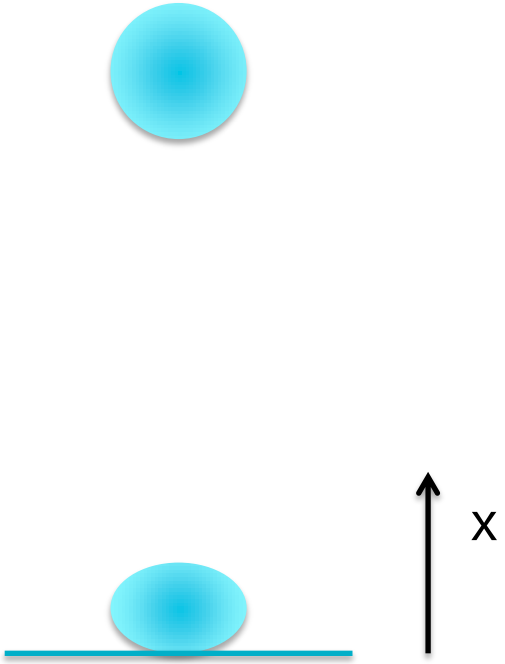
Equations of motion

Free fall and jump: $m\,\ddot{x} + d_{fall}\,\dot{x} = -mg$

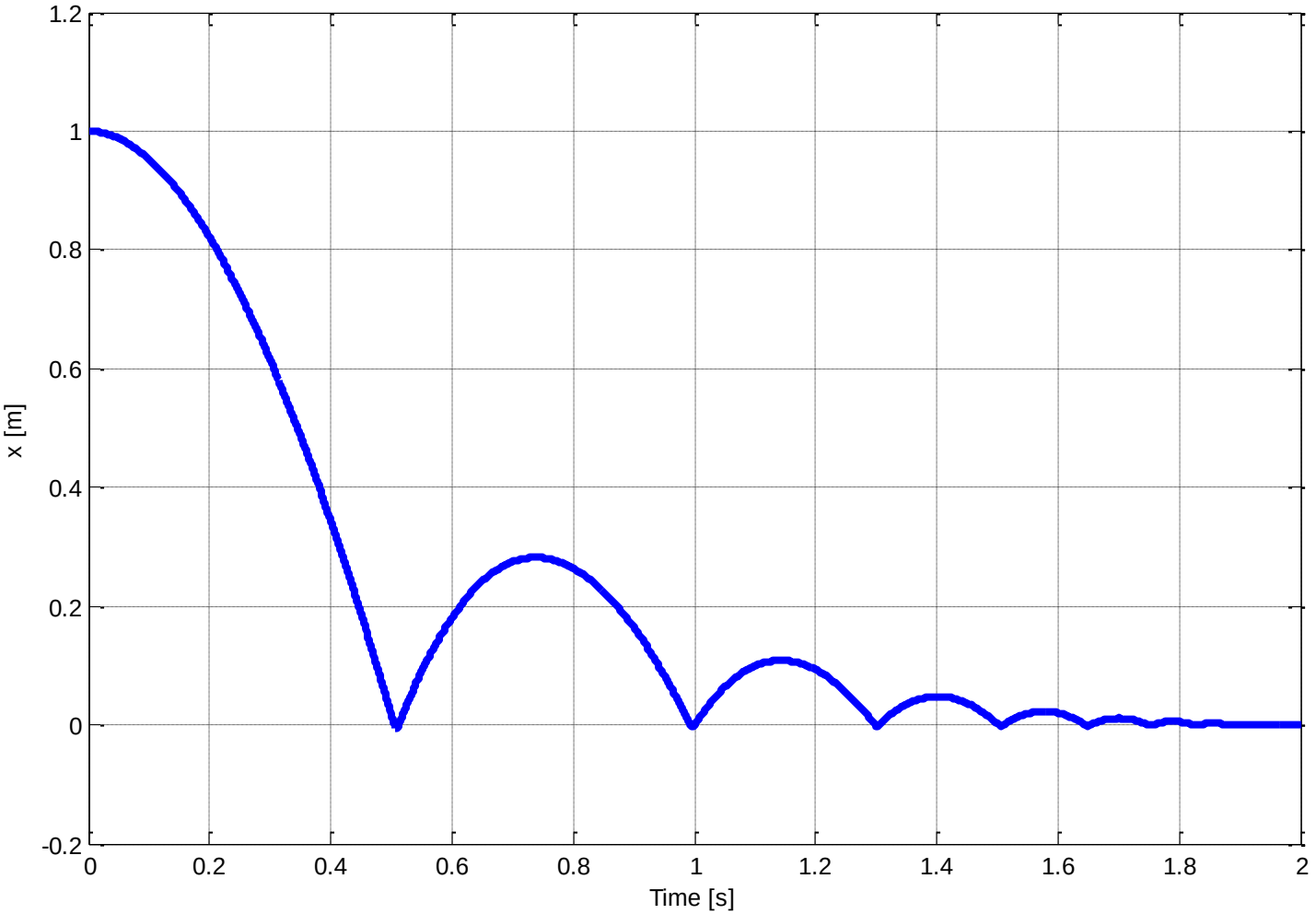
Contact phase: $m\,\ddot{x} + d\,\dot{x} + c\,x = -mg$

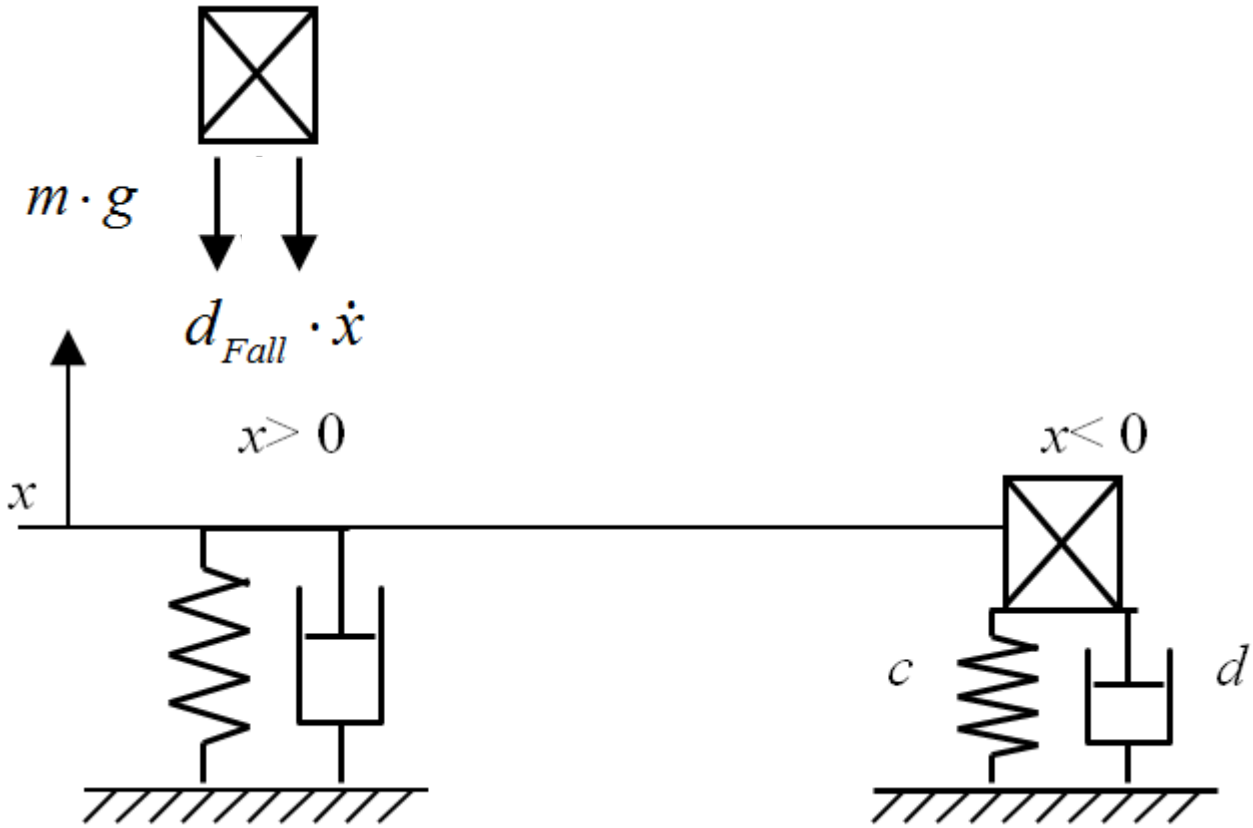
Free Falling Ball

$x_0 = 1\,m$	Initial height
$m = 0.285\,kg$	Weight of the ball
$g = 9.81\,m/s^2$	Gravitational acceleration
$d_{fall} = 0.4\,Ns/m$	Velocity proportional damping during free fall and jump
$d = 22.2\,Ns/m$	Velocity proportional damping during contact phase
$c = 52800\,N/m$	Spring stiffness during contact phase



Free Falling Ball




$m \cdot g$
$d_{Fall} \cdot \dot{x}$
x
$x > 0$
$x < 0$
c
d