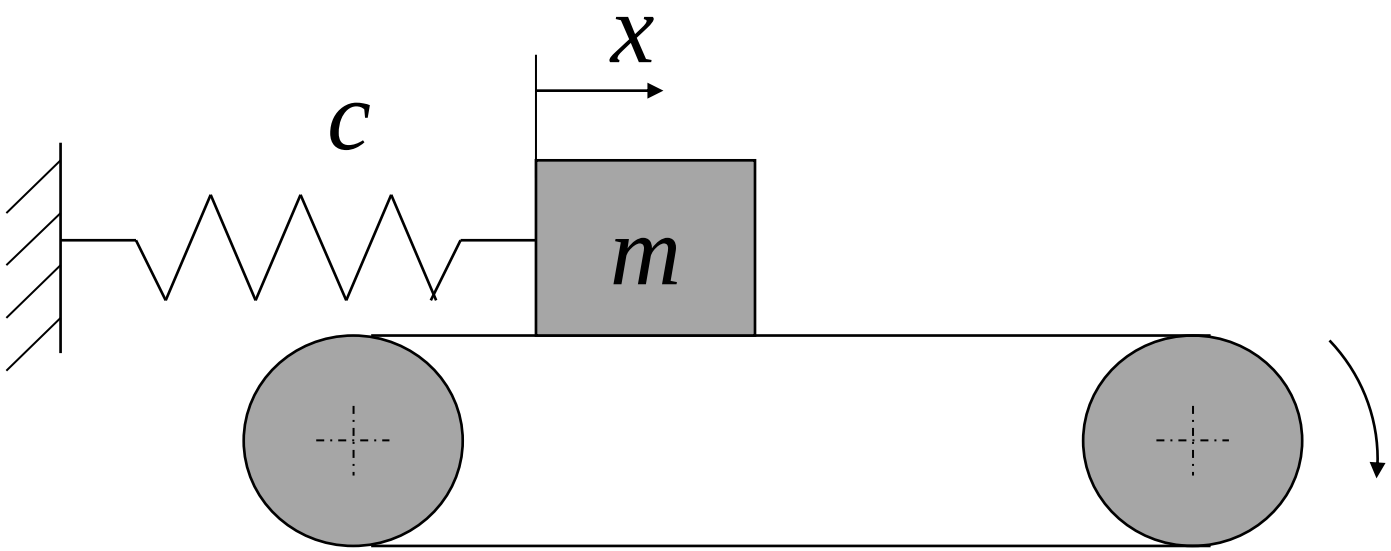
Solving Differential Equations Mechanical Systems

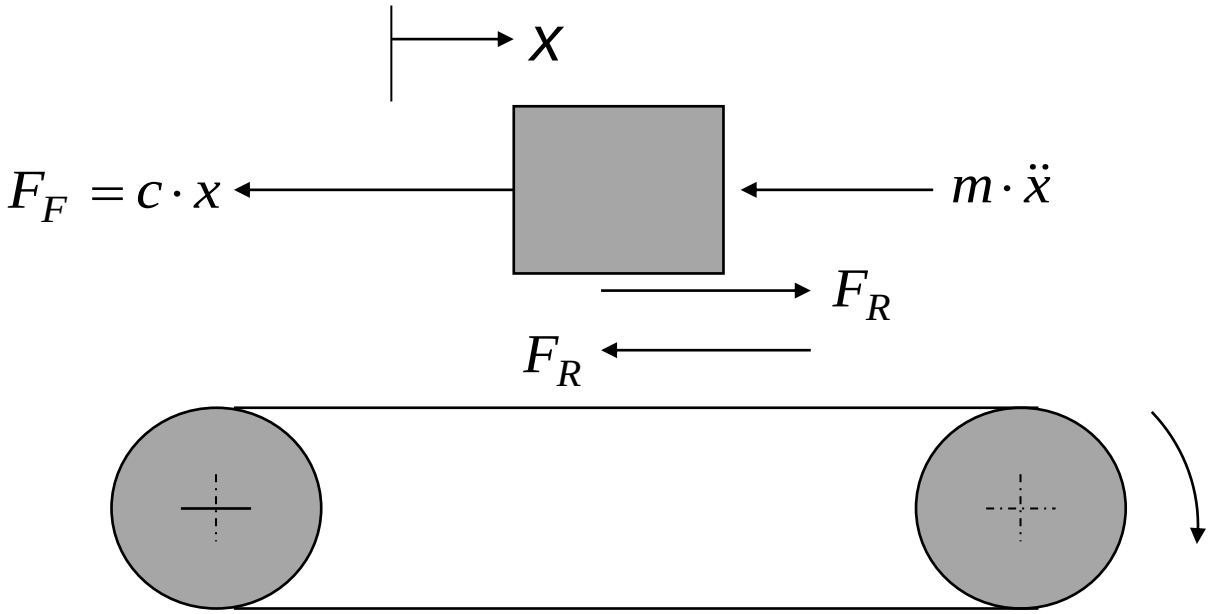
Faculty of Technology and Bionics

Problem: Stick slip

A mass is placed on a conveyer belt and is either sticking or sliding on it.
Task: Simulate the motion of the mass by use of an appropriate friction model.

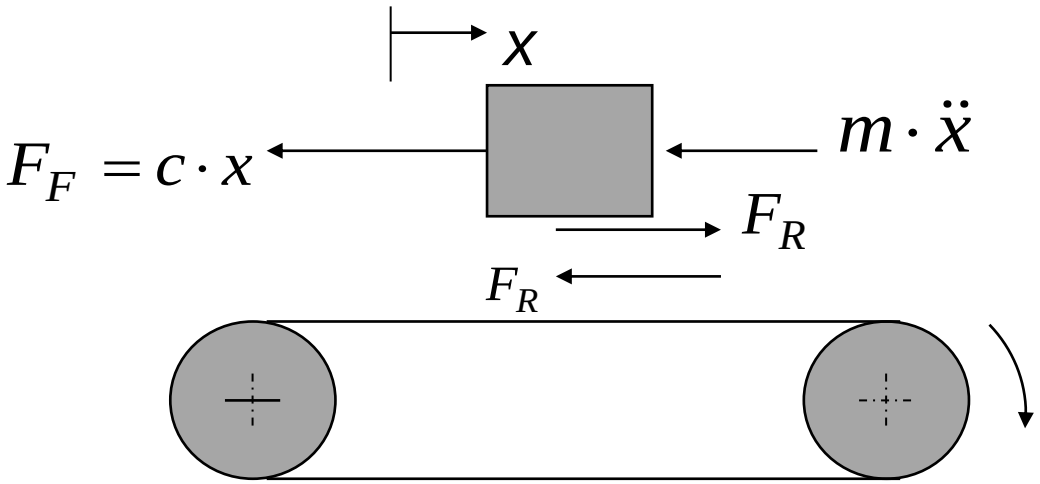


Mechanical Model: Free-body diagram



$F_R =$ friction force

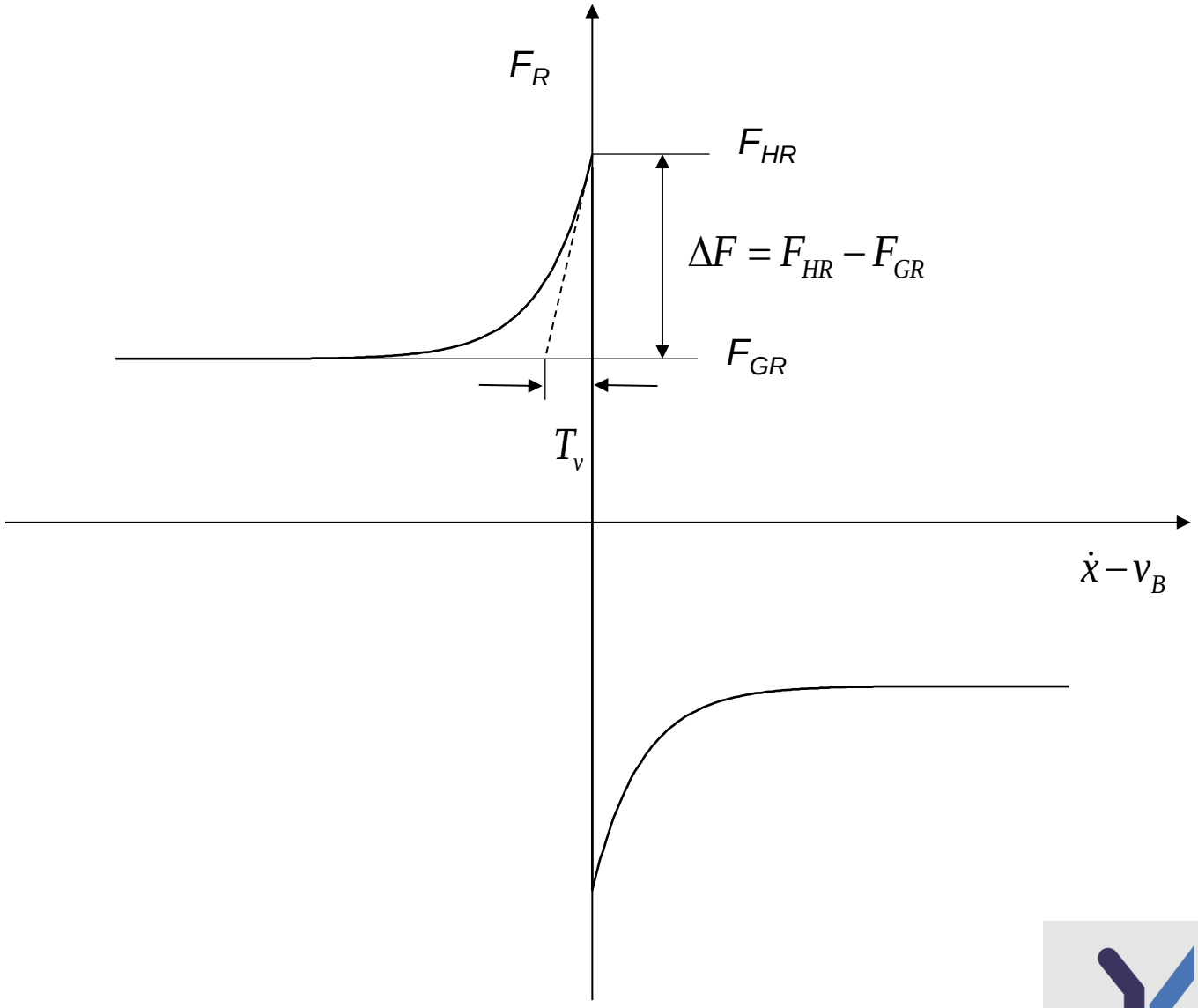
Mechanical Model: Free-body diagram



Equation of Motion:

$$m \cdot \ddot{x} + c \cdot x = F_R$$

Friction Model



Friction Model

$$F_R = -\mathrm{sgn}(\dot{x} - v_B) \cdot \left[F_{GR} + \Delta F \cdot e^{-\frac{|\dot{x} - v_B|}{T_v}} \right]$$

Parameter

Parameter organized in *.m-file

```
c=80; %spring stiffness [N/m]
m=1; %mass of block [kg]
FGR=7; %dynamic friction [N]
FHR=10; %static friction [N]
dF=FHR-FGR; %Difference of friction coefficients [N]
vB=0.1; %speed of conveyer belt [m/s]
Tv=0.1;%time constant (Abklingkonstante) [m/s]
```

Results