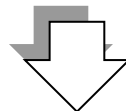
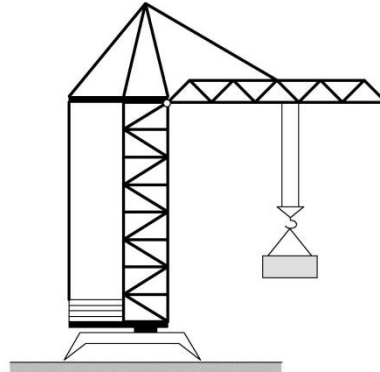


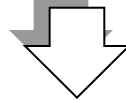


Analyse technischer Systeme

Beispiel 1: Gleichgewicht eines Ladekranes



FEM



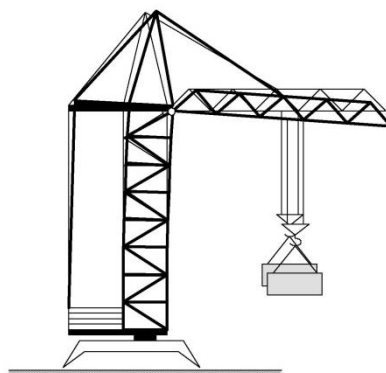
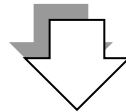
Bewegungsgleichungen $M \cdot \ddot{y} + K \cdot y = h$



lineares Gleichungssystem $K \cdot y_0 = h$

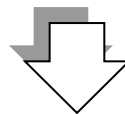
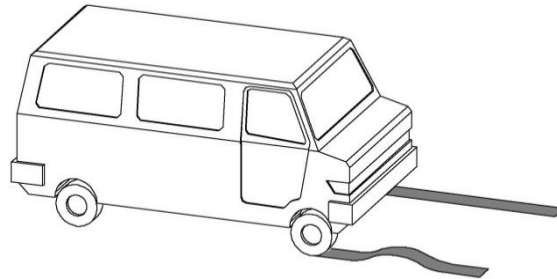


statisches Gleichgewicht y_0

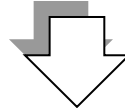




Beispiel 2: Durch Fahrbahnebenenheiten hervorgerufene Fahrzeugschwingungen



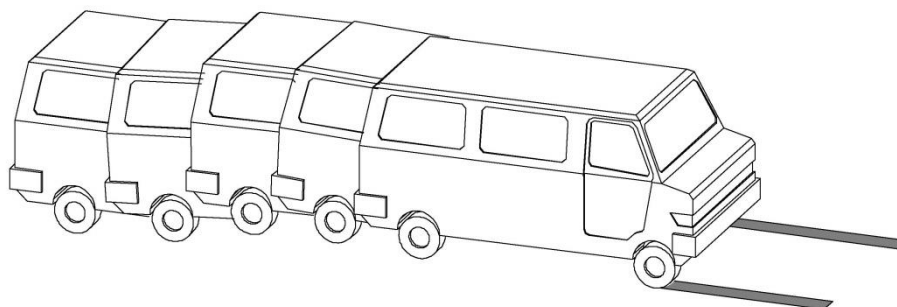
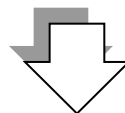
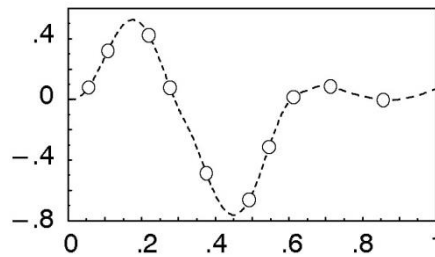
MKS



Bewegungsgleichungen: $M(\mathbf{y}, t) \cdot \ddot{\mathbf{y}} + \mathbf{k}(\mathbf{y}, \dot{\mathbf{y}}, t) = \mathbf{q}(\mathbf{y}, \dot{\mathbf{y}}, t)$

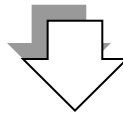
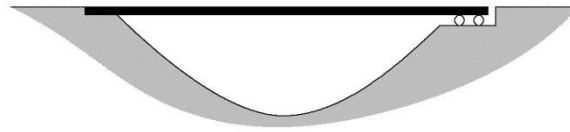


Anfangswertproblem $\dot{\mathbf{x}} = \mathbf{f}(\mathbf{x}, t), \quad \mathbf{x}(0) = \mathbf{x}_0$

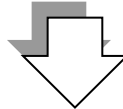




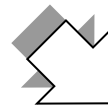
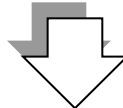
Beispiel 3: Eigenfrequenzen einer Brücke



kontinuierliches System

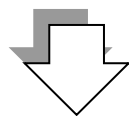


Differentialgleichungen der Biegeschwingungen $\rho A \frac{\partial^2 w}{\partial t^2} + \frac{EI}{L^4} \frac{\partial^4 w}{\partial x^4} = 0$
Randbedingungen $w(0) = w(1) = w'(0) = w'(1) = 0$



Hilfsgleichung

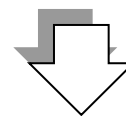
$$\det A_1 = 2 \cos(\gamma) \cosh(\gamma) - 2 = 0$$



Nullstellen γ_i

Eigenwertproblem

$$A_2 \cdot \hat{w} = \lambda \hat{w}$$



Eigenwerte λ_i



Eigenfrequenzen ω_i