

Solution for assignment 11a:

For a bilinear kinetic Energy we find by differentiation and carrying the sum over  $i$  out

$$\begin{aligned}\sum_i \dot{q}_i \frac{\partial T}{\partial \dot{q}_i} &= \sum_i \dot{q}_i \frac{\partial}{\partial \dot{q}_i} \sum_{j,k} a_{jk} \dot{q}_j \dot{q}_k = \sum_i \dot{q}_i \sum_{j,k} a_{jk} (\delta_{ij} \dot{q}_k + \dot{q}_j \delta_{ik}) \\ &= \sum_{j,k} a_{jk} (\dot{q}_j \dot{q}_k + \dot{q}_j \dot{q}_k) = 2T .\end{aligned}$$

Solution for assignment 11b: Motivation of generalized momentum definition.

$$\frac{\partial}{\partial \dot{x}_i} \left( \frac{1}{2} m \vec{v}^2 - V(\vec{x}) \right) = m \dot{x}_i = p_i .$$