Energiegleichung in integraler Form:

$$\int_V \frac{\partial}{\partial t}\left[\rho\left(e+\frac{\vec{v}^2}{2}\right)\right]dV + \int_O \rho\left(e+\frac{\vec{v}^2}{2}\right)(\vec{v}\cdot\vec{n})dO =$$

$$= \int_V \left(\rho\vec{v}\cdot\vec{f}^B\right)dV - \int_O (p\,\vec{v}\cdot\vec{n})dO +$$

$$+ \int_O (\vec{v}\cdot\vec{\tau}_x)n_x\,dO + \int_O (\vec{v}\cdot\vec{\tau}_y)n_y\,dO + \int_O (\vec{v}\cdot\vec{\tau}_z)n_z\,dO +$$

$$- \int_O (\vec{q}\cdot\vec{n})dO + \int_V \dot{q}_Q dV$$

Für Festkörper gilt: $\vec{v} = 0 \text{ , } \vec{\tau} = 0$

$$\Rightarrow \int_V \frac{\partial}{\partial t}[\rho e]dV = - \int_O (\vec{q}\cdot\vec{n})dO + \int_V \dot{q}_Q dV$$

Energiegleichung in differentieller Form:

$$\frac{\partial}{\partial t}\left[\rho\left(e+\frac{\vec{v}^2}{2}\right)\right] + \left(\vec{\nabla}\cdot\rho\vec{v}\left(e+\frac{\vec{v}^2}{2}\right)\right) =$$

$$= \rho\left(\vec{v}\cdot\vec{f}^B\right) - \left(\vec{\nabla}\cdot p\,\vec{v}\right) + \frac{\partial}{\partial x}\left(u\tau_{xx}+v\tau_{xy}+w\tau_{xz}\right) +$$

$$+ \frac{\partial}{\partial y}\left(u\tau_{yx}+v\tau_{yy}+w\tau_{yz}\right) + \frac{\partial}{\partial z}\left(u\tau_{zx}+v\tau_{zy}+w\tau_{zz}\right) - \left(\vec{\nabla}\cdot\vec{q}\right) + \dot{q}_Q$$