

In advanced mechanics, there are several things on which I am still a little confused:

Euler originally drafted the equation

$$Q_k = \frac{d}{dt} \frac{\partial T}{\partial \dot{q}} - \frac{\partial T}{\partial q}$$

Whereas we use Lagrange's equation

$$0 = \frac{d}{dt} \frac{\partial L}{\partial \dot{q}} - \frac{\partial L}{\partial q} \text{ where } L = T - V \text{ to solve for equations of motion.}$$

Do we use the Euler equation for anything specific?

I am also confused when we have non-holonomic equations where the energies depend on  $\dot{\vec{r}}$  such as frictional forces, how does this change the Lagrange equations?

Finally, I am very confused by the  $\delta$  operator when it is used in conjunction with an integral such as Hamilton's equation

$$\delta \int_{t_1}^{t_2} L dt = 0. \text{ Why } \delta \text{ and not just } d?$$