

## 4.5: Generalized Momenta and Forces

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For the above orbital Lagrangian,  $dL/d\dot{r} = m\dot{r} = p_r$  the momentum in the  $r$  -direction, and  $dL/d\dot{\theta} = mr^2\dot{\theta} = p_\theta$ , the angular momentum associated with the variable  $\theta$ .

The *generalized momenta* for a mechanical system are defined by

$$p_i = \frac{\partial L}{\partial \dot{q}_i} \quad (4.5.1)$$

Less frequently used are the *generalized forces*,  $F_i = \partial L / \partial q_i$ , defined to make the Lagrange equations look Newtonian,  $F_i = \dot{p}_i$ .

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