Noether's Theorem for Functionals Depending on Higher-Order Derivatives

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Abstract

1 The Euler-Lagrange Equations in general

Suppose we have a functional of the form $J[u] = \int F(x_i; u_j; \frac{\partial u_j}{\partial x_i}; \frac{\partial^2 u_j}{\partial x_j x_k}; \cdots) dx_1 \cdots dx_n$. We wish to find a sufficient condition that it is stationary.

2 General Expression for the variation of a functional

3 Conserved flows

We wish to get an expression of the form

$$\sum_{i=1}^{n} \frac{\partial}{\partial x_i} M = 0$$