

## CHAPTER OVERVIEW

### 13: Lagrangian Mechanics

Sometimes it is not all that easy to find the equations of motion and there is an alternative approach known as **lagrangian mechanics** which enables us to find the equations of motion when the newtonian method is proving difficult. In lagrangian mechanics we start, as usual, by drawing a large, clear diagram of the system, using a ruler and a compass. But, rather than drawing the forces and accelerations with red and green arrows, we draw the *velocity* vectors (including angular velocities) with blue arrows, and, from these we write down the *kinetic energy* of the system. If the forces are *conservative* forces (gravity, springs and stretched strings), we write down also the *potential energy*. That done, the next step is to write down the *lagrangian equations of motion* for each coordinate. These equations involve the kinetic and potential energies, and are a little bit more involved than  $F = ma$ , though they do arrive at the same results.

[13.1: Introduction to Lagrangian Mechanics](#)

[13.2: Generalized Coordinates and Generalized Forces](#)

[13.3: Holonomic Constraints](#)

[13.4: The Lagrangian Equations of Motion](#)

[13.5: Acceleration Components](#)

[13.6: Slithering Soap in Conical Basin](#)

[13.7: Slithering Soap in Hemispherical Basin](#)

[13.8: More Lagrangian Mechanics Examples](#)

[13.9: Hamilton's Variational Principle](#)

---

This page titled [13: Lagrangian Mechanics](#) is shared under a [CC BY-NC 4.0](#) license and was authored, remixed, and/or curated by [Jeremy Tatum](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.