

## CHAPTER OVERVIEW

### 6: Eigenvalue Problems

An **eigenvalue problem** is a matrix equation of the form

$$\mathbf{A}\vec{x} = \lambda\vec{x}, \quad (6.1)$$

where  $\mathbf{A}$  is a known  $N \times N$  matrix. The problem is to find one (or more than one) non-zero vector  $\vec{x}$ , which is called an **eigenvector**, and the associated  $\lambda \in \mathbb{C}$ , which is called an **eigenvalue**. Eigenvalue problems are ubiquitous in practically all fields of physics. Most prominently, they are used to describe the "modes" of a physical system, such as the modes of a classical mechanical oscillator, or the energy states of an atom.

Before discussing numerical solutions to the eigenvalue problem, let us quickly review the relevant mathematical facts.

[6.1: Basic Facts about Eigenvalue Problems](#)

[6.2: Numerical Eigensolvers](#)

---

This page titled [6: Eigenvalue Problems](#) is shared under a [CC BY-SA 4.0](#) license and was authored, remixed, and/or curated by [Y. D. Chong](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.