

CHAPTER OVERVIEW

8: Sparse Matrices

A **sparse matrix** is a matrix in which most of the entries are zero. Such matrices are very commonly encountered in finite-difference equations. For example, when we discretized the 1D Schrödinger wave equation with Dirichlet boundary conditions, we saw that the Hamiltonian matrix had the tridiagonal form

$$\mathbf{H} = -\frac{1}{2h^2} \begin{bmatrix} -2 & 1 & & \\ 1 & -2 & \ddots & \\ & \ddots & \ddots & 1 \\ & & 1 & -2 \end{bmatrix} + \begin{bmatrix} V_0 & & & \\ & V_1 & & \\ & & \ddots & \\ & & & V_{N-1} \end{bmatrix}. \quad (8.1)$$

Hence, if there are N diagonalization points, the Hamiltonian matrix has a total of N^2 entries, but only $O(N)$ of these entries are non-zero.

[8.1: Sparse Matrix Algebra](#)

[8.2: Sparse Matrix Formats](#)

[8.3: Using Sparse Matrices](#)

[8.4: Example- Particle-in-a-Box Problem](#)

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