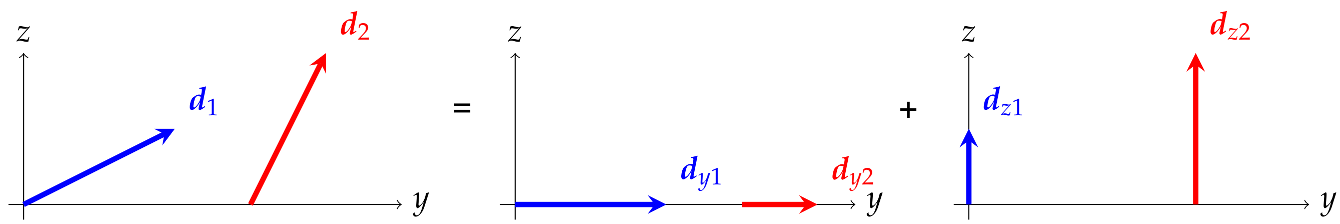
Tight-binding Solver

Claire West

September 11, 2019

1 Problem set up



2 Explanation of the code

Two coupled dipoles:

$$\begin{aligned} m_1\ddot{\mathbf{x}}_1 + m_1\gamma_1\dot{\mathbf{x}}_1 + m_1\omega_{01}^2\mathbf{x}_1 - g_{12}\mathbf{x}_2 = 0 \\ m_1\ddot{\mathbf{x}}_2 + m_2\gamma_2\dot{\mathbf{x}}_2 + m_2\omega_{02}^2\mathbf{x}_2 - g_{21}\mathbf{x}_1 = 0 \end{aligned} \tag{1}$$

Using the steady-state approximation where $\mathbf{x}_i = \mathbf{x}_{0i}e^{-i\omega t}$ and collecting terms leads to the following matrix equation.

$$\begin{bmatrix} -\omega^2 - i\gamma_1\omega + \omega_{01}^2 & -g_{12}/m_1 \\ -g_{21}/m_2 & -\omega^2 - i\gamma_2\omega + \omega_{02}^2 \end{bmatrix} \begin{bmatrix} \mathbf{x}_{01} \\ \mathbf{x}_{02} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \tag{2}$$

To solve for $\mathbf{x}_{01}, \mathbf{x}_{02}$, we can employ Cramer's Rule.