34.1. Briefly— Find $I$ ($T+U$ spring).

Find equations of motion.

Put equations in matrix form.

Let $\ddot{\mathbf{x}} = -\omega^2 \mathbf{x}$, e.g., all variables have harmonic solutions with a single frequency $\rightarrow$ Normal modes.

$-\omega^2 \mathbf{M} \ddot{\mathbf{x}} = -\mathbf{k} \mathbf{x}$

$\mathbf{M}^{-1} \mathbf{K} \ddot{\mathbf{x}} = \omega^2 \mathbf{x}$

Use Eigensystem to solve in Mathematica. Normal modes are eigenvectors, $\omega^2$ are eigenvalues.

34.2. Energy is transferred from pendulum to pendulum in beats.

34.3. Normal modes: everything oscillates at the same frequency.

All solutions are linear combinations of the normal modes.