2 Waves and Oscillations

2.1 Beats from a Vibrating Wire

- **Initial State:** $f_1 = 256 \pm 5$ Hz $\implies f_1 = 261$ Hz or $f_1 = 251$ Hz.

- **Final State:** $f_2 = 256 \pm 3$ Hz $\implies f_2 = 259$ Hz or $f_2 = 253$ Hz.

- **Condition:** Tension increases, so frequency increases ($f_2 > f_1$). This implies the initial frequency must be $f_1 = 251$ Hz. Both $f_2 = 259$ Hz and $f_2 = 253$ Hz are possible final frequencies.

- **Ratio Calculation:** Since $f \propto \sqrt{F}$, we have $\frac{F_2}{F_1} = \left(\frac{f_2}{f_1}\right)^2$.

    - Case 1: $\frac{F_2}{F_1} = \left(\frac{259}{251}\right)^2 \approx \mathbf{1.065}$
    - Case 2: $\frac{F_2}{F_1} = \left(\frac{253}{251}\right)^2 \approx \mathbf{1.016}$