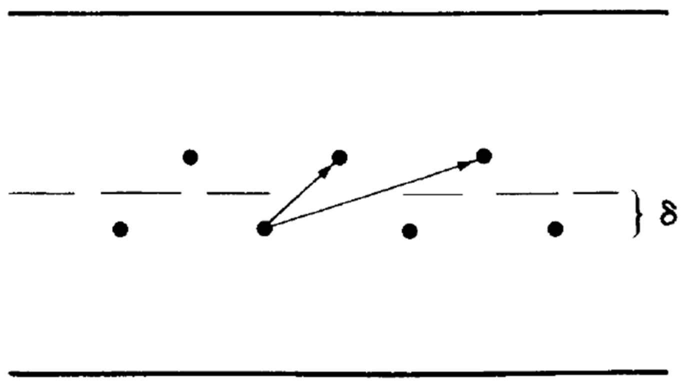

Figure 1: Wire displacement about the undisplaced center (dashed) line. Undisplaced wires are separated by a distance, s.

This is all worked out in Fabio Sauli's CERN report, Principles of Operation of Multiwire Proportional and Drift Chambers. `http://lhcb-muon.web.cern.ch/lhcb-muon/documents/Sauli_77-09.pdf`.

0.1 Problem 1

$$F = qE = (CV_0)E \tag{1}$$

$$= (CV_0)\frac{q}{2\pi\varepsilon_0}\frac{1}{r} \tag{2}$$

$$= \frac{(CV_0)^2}{2\pi\varepsilon_0}\frac{1}{r} \tag{3}$$

0.2 Problem 2

$$\sum_n F_{\perp n} \simeq 2\sum_n \frac{(CV_0)^2}{2\pi\varepsilon_0}\frac{2\delta}{n^2 s^2} = \frac{(CV_0)^2\pi}{4\varepsilon_0}\frac{\delta}{s^2} \tag{4}$$

0.3 Problem 3

The wire's displacement δ is really a function of the position along the length of the wire, $\delta(x)$. $\delta(0) = \delta(L) = 0$ because the wires are fixed at the end.

The restoring force should be equal and opposite of the tension in Equation 4.

$$R = T\frac{d^2\delta(x)}{dx^2} = -\frac{(CV_0)^2\pi}{4\varepsilon_0}\frac{\delta(x)}{s^2} \tag{5}$$

$$\delta(x) = \delta_0 \sin\left(\frac{CV_0}{2s}\sqrt{\frac{\pi}{\varepsilon_0 T}}x\right) \tag{6}$$

$$\frac{CV_0}{2s}\sqrt{\frac{\pi}{\varepsilon_0 T}}L = \pi \rightarrow T = \frac{1}{4\pi\varepsilon_0}\left(\frac{CV_0 L}{s}\right)^2 \tag{7}$$