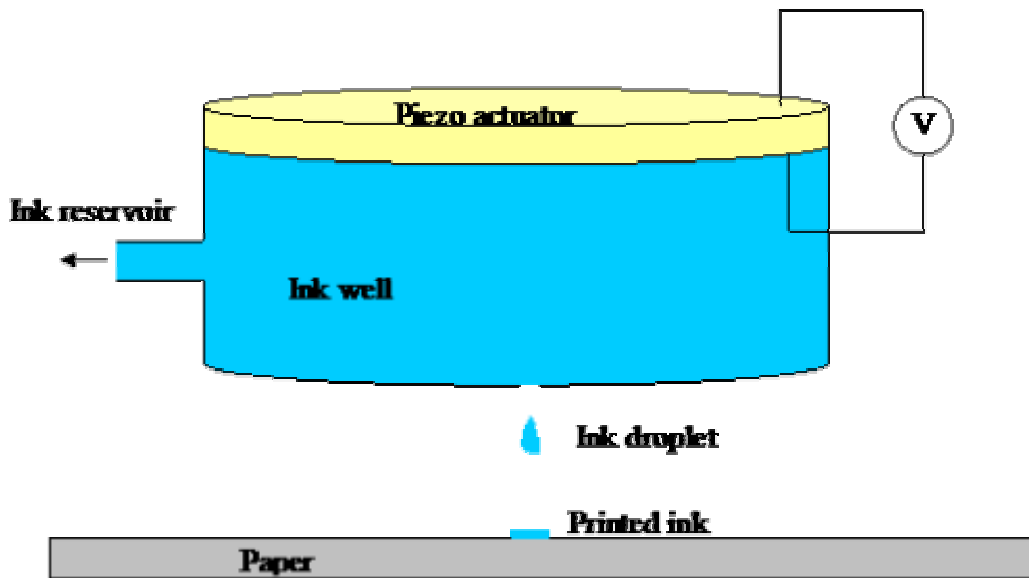


Solution to homework #8

Problem 1



First, let us calculate the volume of the droplet ejected out of the ink well each time the piezoactuator is supplied with a voltage pulse. Assuming circular drops printed on the paper, the print resolution of 600 dpi means that there will be 600 circular dots per in. That is the diameter of a single dot is $1/600$ in = 0.0017 in = 42.3 μm . Since the printed film is 2 μm thick, the volume of the droplet is

$$\frac{\pi(42.3E-6)^2}{4}(2E-6) = 2.8106E-15 \text{ m}^3.$$

To eject a droplet of this volume, the PZT disk must displace along the longitudinal axis by δ , which is given by

$$\delta = \frac{\text{volume of the droplet}}{\text{area of c/s of the ink well}} = \frac{2.8106E-15}{\pi(2E-3)^2/4} = 8.9464E-10 \text{ m}$$

Since the thickness of the PZT disk is 10 μm , the strain in the longitudinal axis of the disk is given by

$$\epsilon = \frac{\delta}{L} = \frac{8.9464E-10}{10E-6} = 8.9464E-5$$

Noting the relationship between the voltage per unit length and the strain, $v d = \epsilon$ where $d = 480E-12 \text{ m/V}$, the required voltage is given by

$$v = \frac{\epsilon}{d} = \frac{8.9464E-5}{480E-12} = 1.8638E5 \text{ V/m}$$

For a thickness of 10 μm , the required voltage to be applied on the disk is $1.8638 \approx 1.86 \text{ V}$.