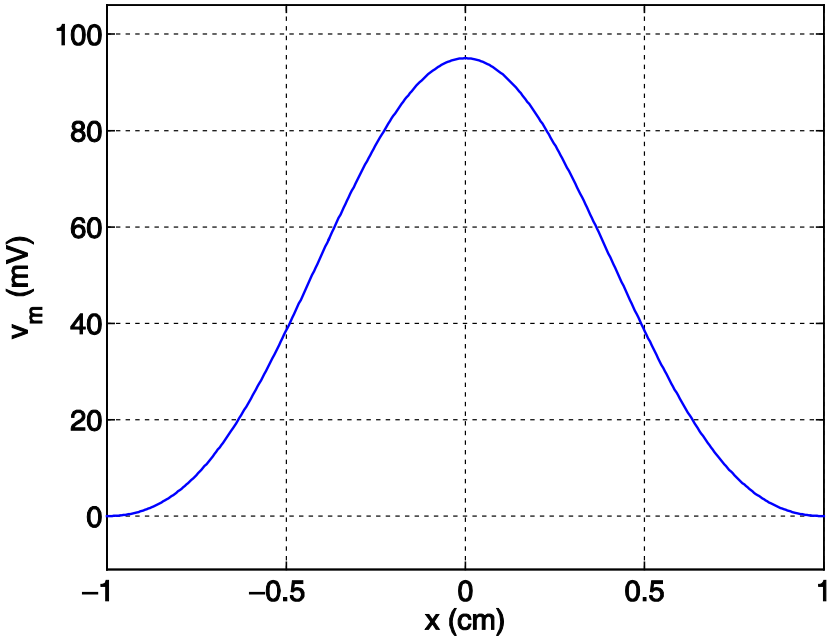
ELEC ENG 3BB3 – Cellular Bioelectricity (2014)

Tutorial 6

1. An action potential with the spatial waveform illustrated below is propagating along a fiber.



The relative transmembrane potential can be described by:

$$v_m = \begin{cases} 95\dfrac{\sin^2(\pi x)}{(\pi x)^2}, & \text{for } |x| \le 1, \\ 0, & \text{for } |x| > 1, \end{cases}$$

where v_m is in units of mV and x is in units of cm.

The fiber has a radius of $a = 2\,\mu\text{m}$ and an axoplasmic conductivity of $\sigma_i = 0.05\,\text{S/cm}$.

a. Find expressions describing *two dipole source density regions* generated by the AP.

b. Find expressions describing *three monopole source density regions* generated by the AP.

c. Find the strengths of *two lumped dipole sources* based on the dipole source densities from part a above.

d. Find the strengths of *three lumped monopole sources* based on the monopole source densities from part b above.

2. Repeat Problem 1 for the AP waveform approximated by a triangle.

3. Repeat Problem 1 for the AP waveform approximated by a rectangle.