

Step current response of the HH Model

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Three possible responses to a step current

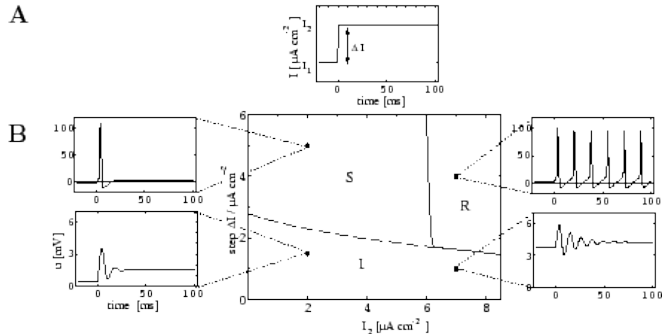


Figure: Phase diagram for stimulation with a step current.

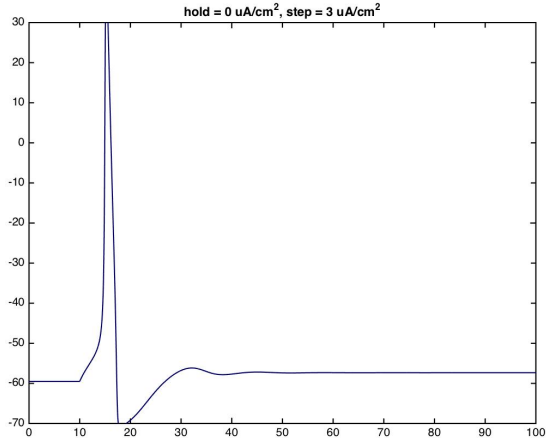


Figure: Simulated single action potential.

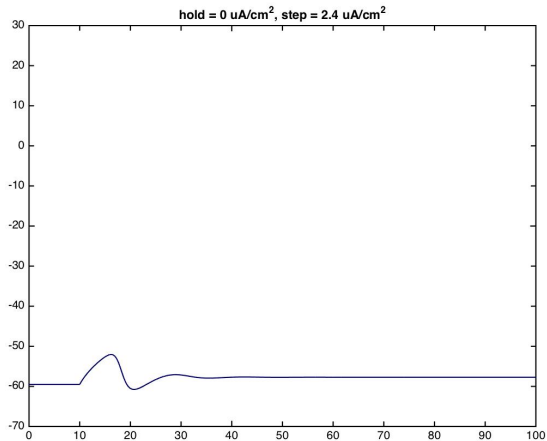


Figure: Simulated ringing response.

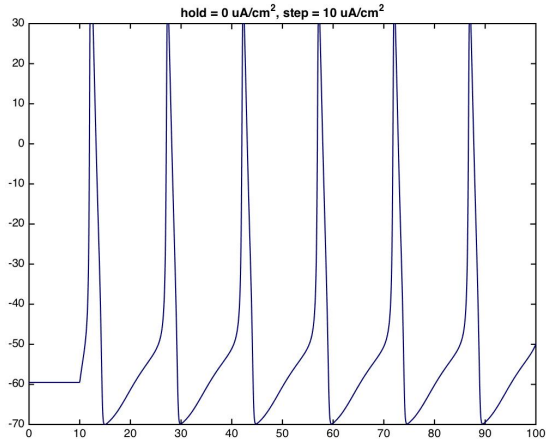


Figure: Simulated train of repeating potentials.

Finding train frequency

We perform a simple FFT of the V_m for different current steps, check out these pictures

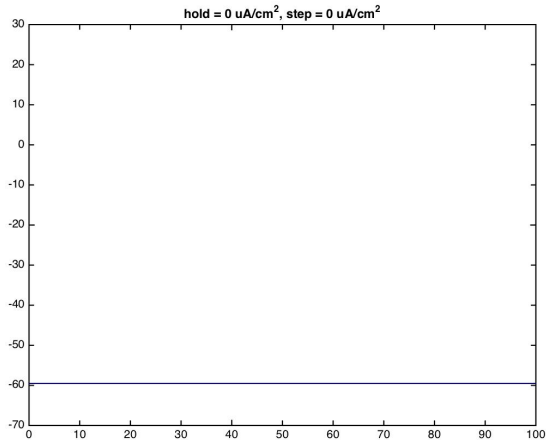


Figure: HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

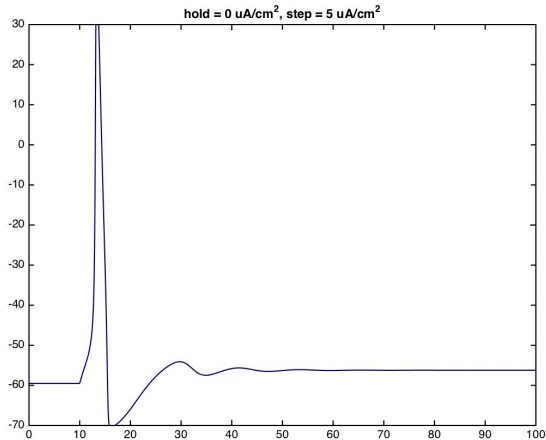


Figure: HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

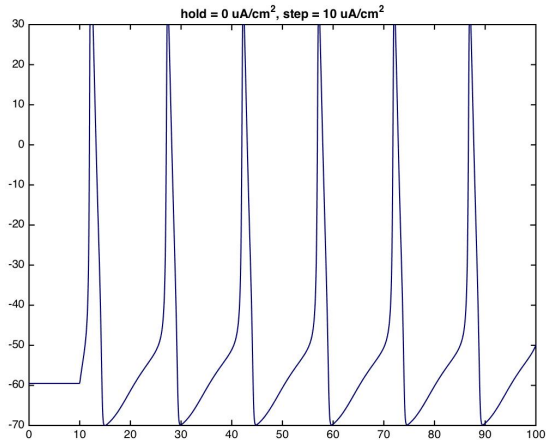


Figure: HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

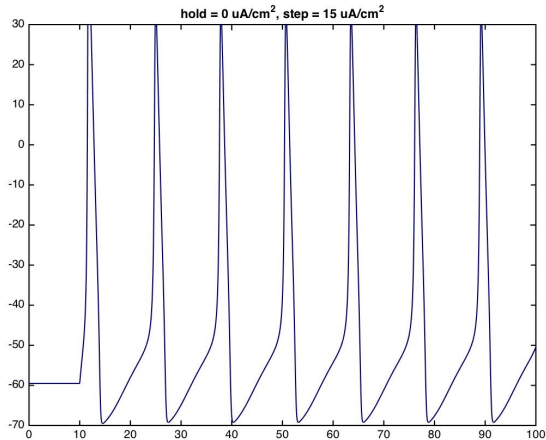


Figure: HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

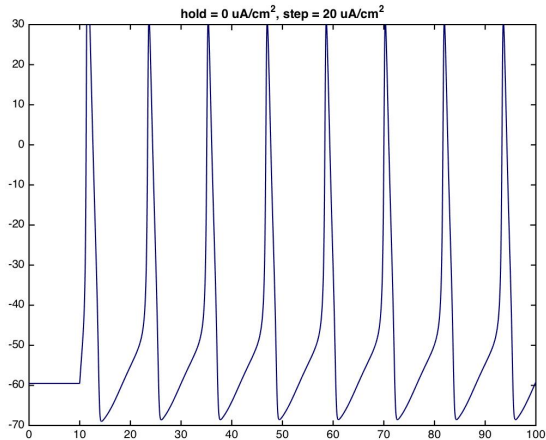


Figure: HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

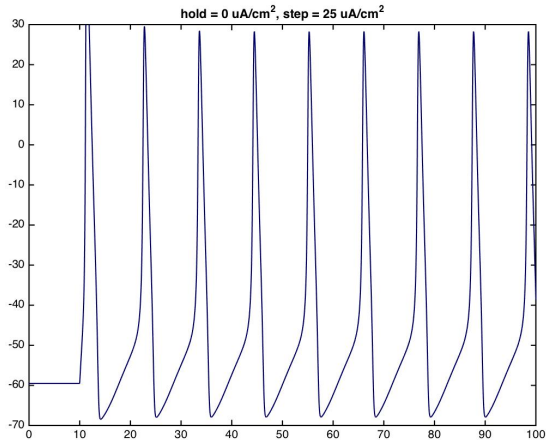


Figure: HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

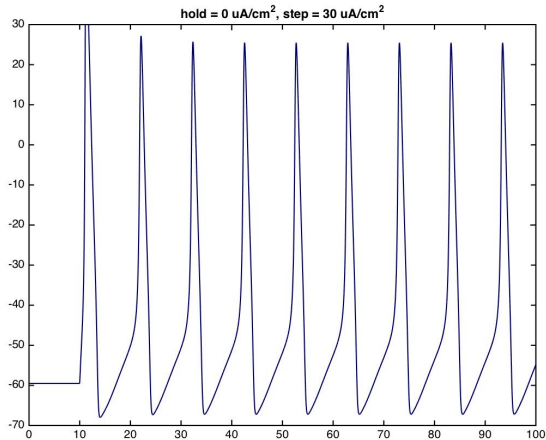


Figure: HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

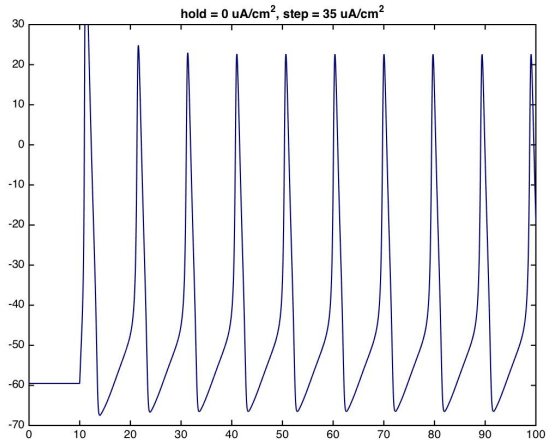


Figure: HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

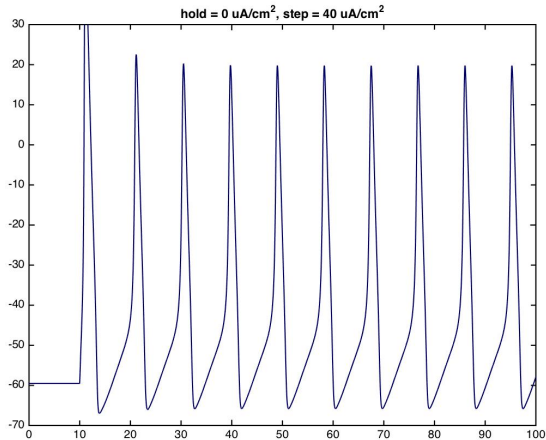


Figure: HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

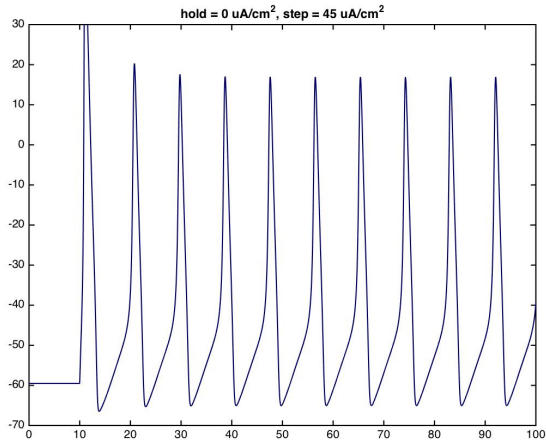


Figure: HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

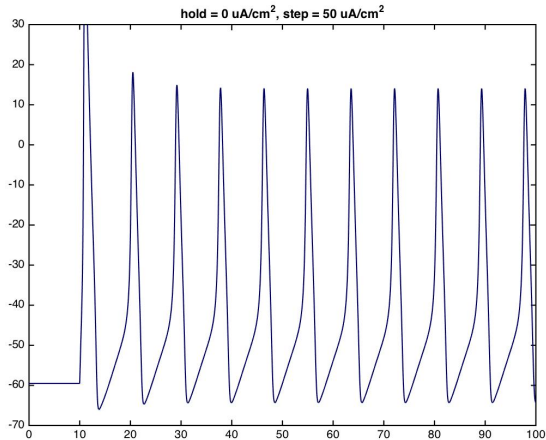


Figure: HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

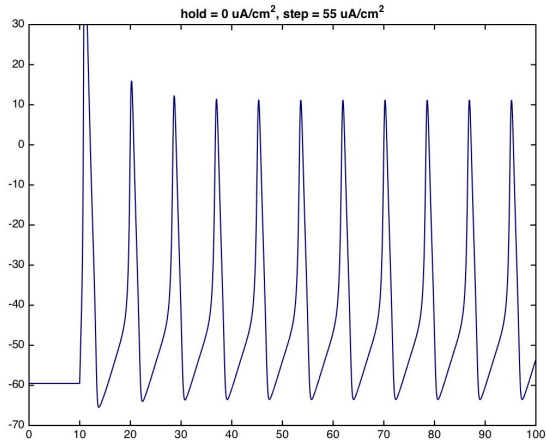


Figure: HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

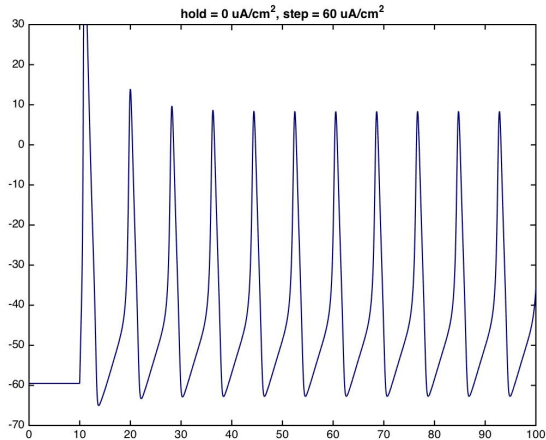


Figure: HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

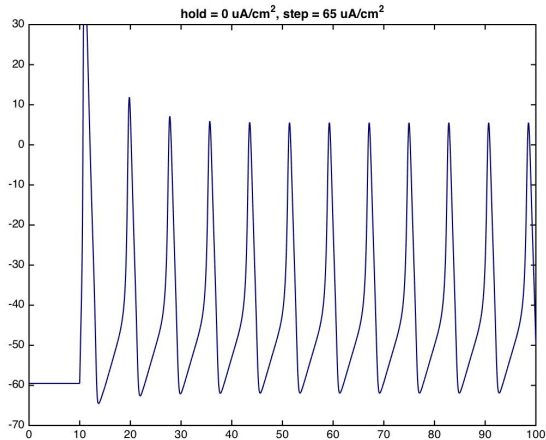


Figure: HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

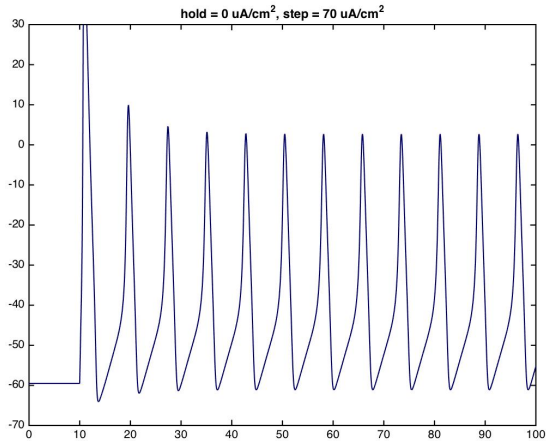


Figure: HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

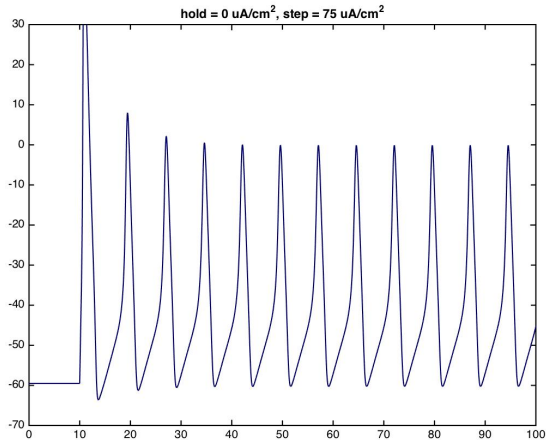


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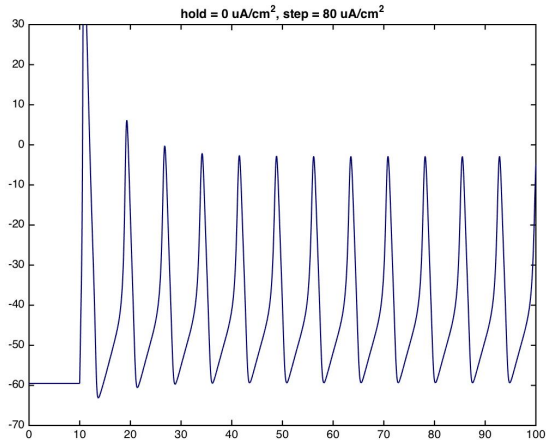


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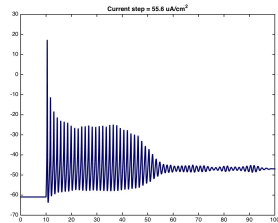
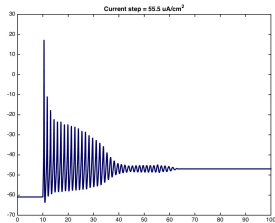


Figure: Incorrect behavior due to low precision

References

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- 2 Weiss, T. F. (1995). Cellular Biophysics. Volume 2: Electrical Properties, MIT Press.
- 3 Blaustein, M.P., Kao, J.P.Y., Matteson, D.R. (2012). Cellular Physiology and Neurophysiology, 2nd edition, Elsevier-Mosby.
- 4 Gerstner, Wulfram, and Werner M. Kistler. Spiking neuron models: Single neurons, populations, plasticity. Cambridge university press, 2002.