

Step current response of the HH Model

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Three possible responses to a step current

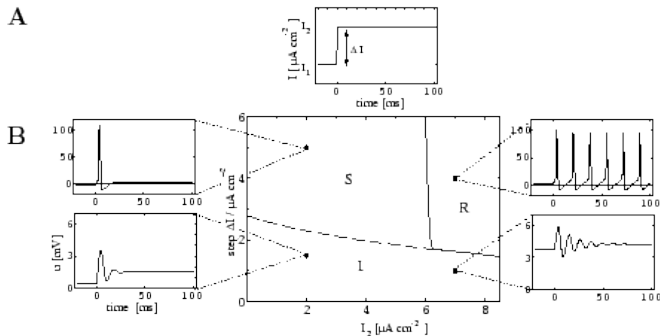


Figure : Phase diagram for stimulation with a step current.

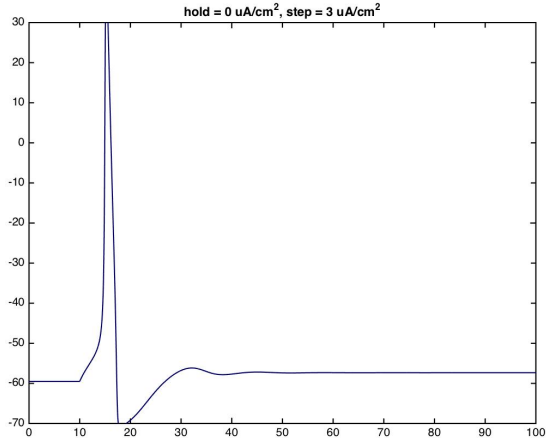


Figure : Simulated single action potential.

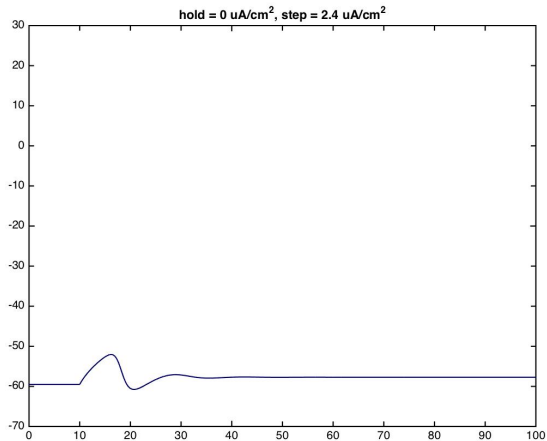


Figure : Simulated ring response.

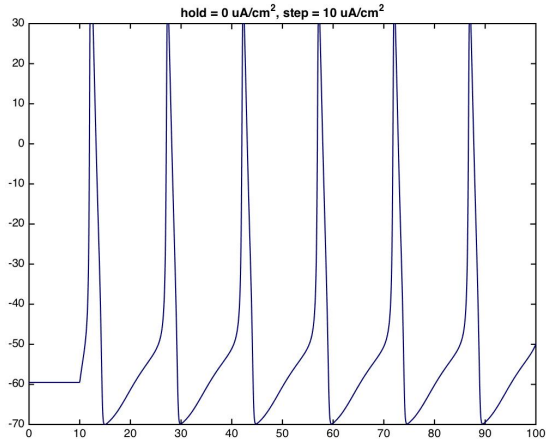


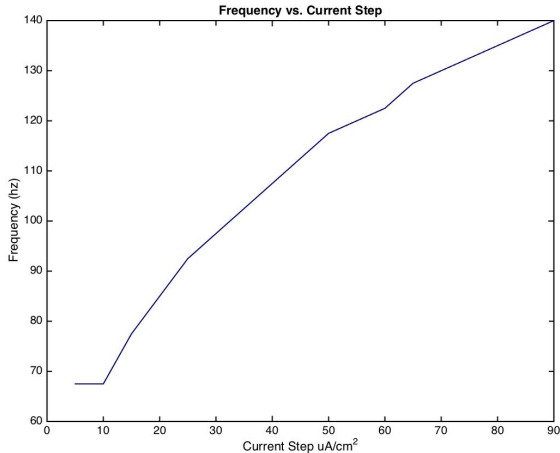
Figure : Simulated train of repeating potentials.

Finding train frequency; LSSA

To find the train frequency we used the Least-Squares spectral analysis method (LSSA). LSSA is a method of estimating a frequency spectrum, based on a least squares fit of sinusoids to data samples, similar to Fourier analysis.

It works *better* than Fourier Analysis on data with variable time intervals such as the ones we are studying.

Train frequency over increasing input step



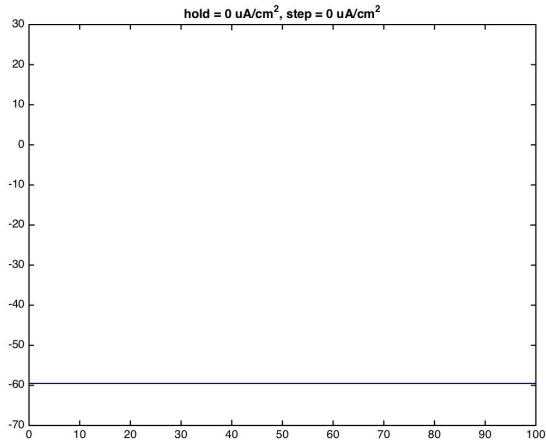


Figure : HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

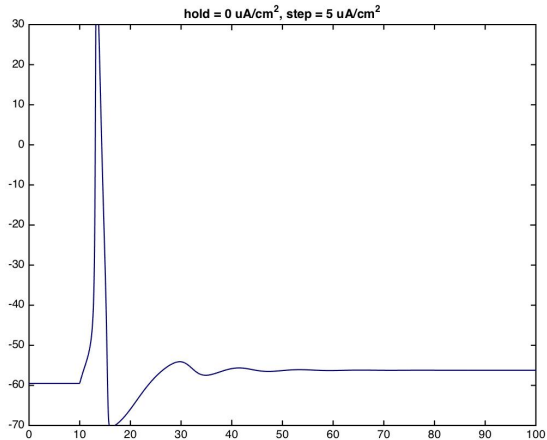


Figure : HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

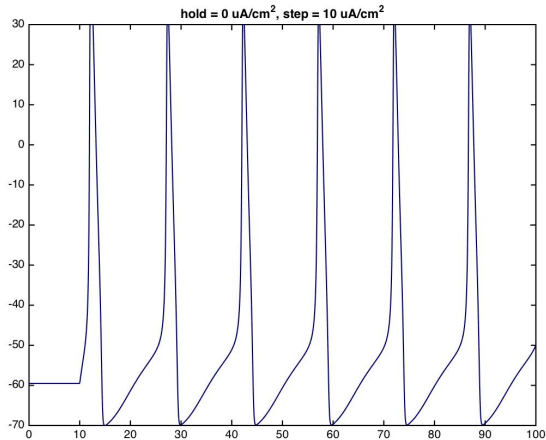


Figure : HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

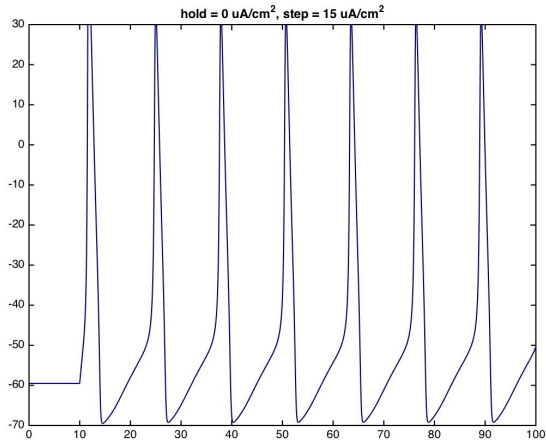


Figure : HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

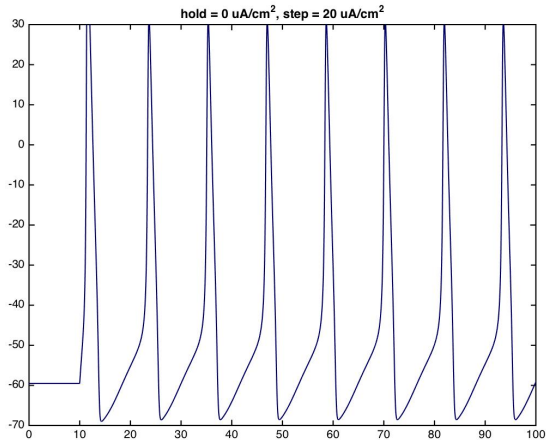


Figure : HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

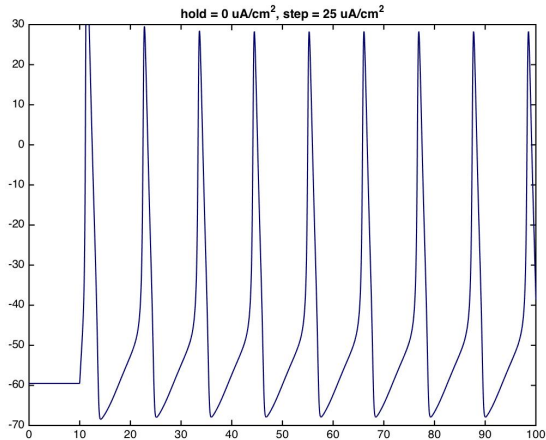


Figure : HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

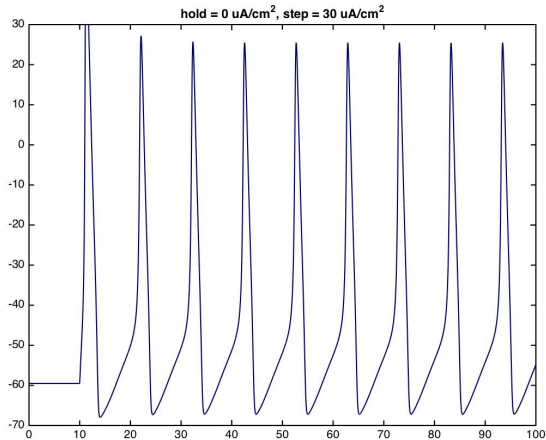


Figure : HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

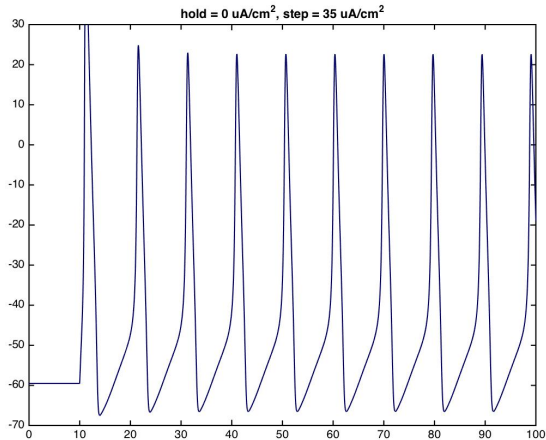


Figure : HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

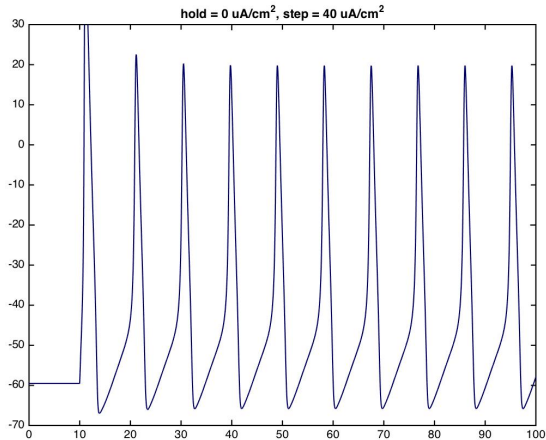


Figure : HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

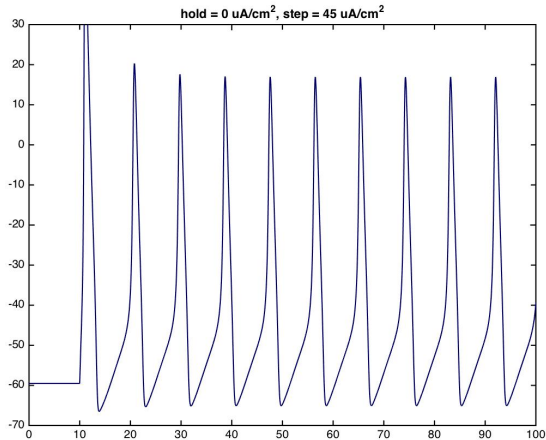


Figure : HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

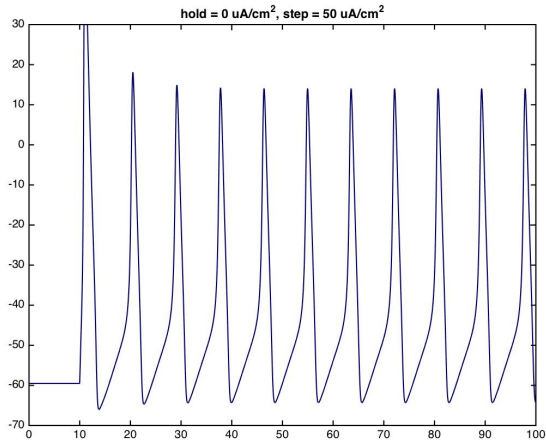


Figure : HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

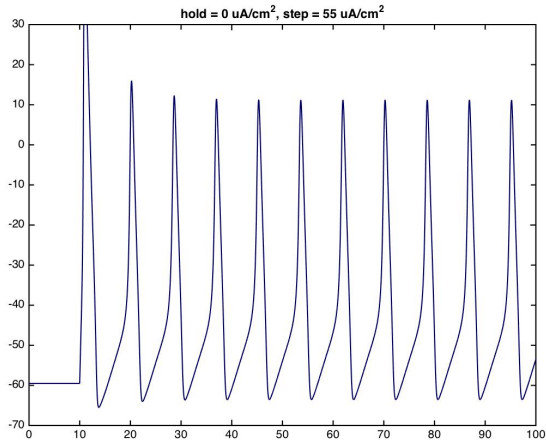


Figure : HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

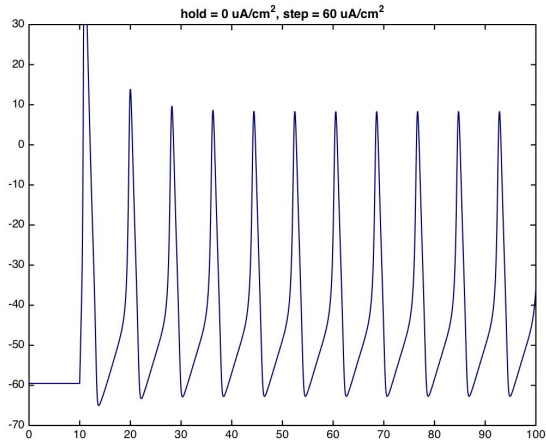


Figure : HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

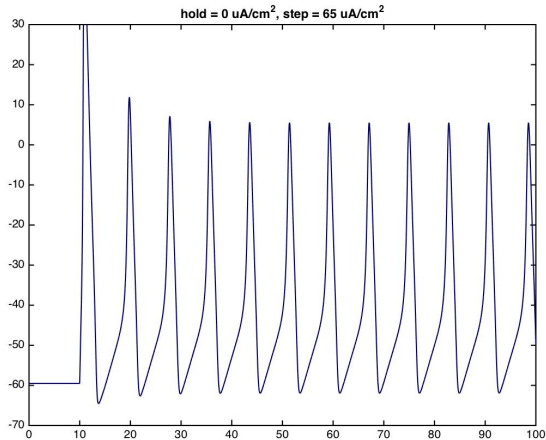


Figure : HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

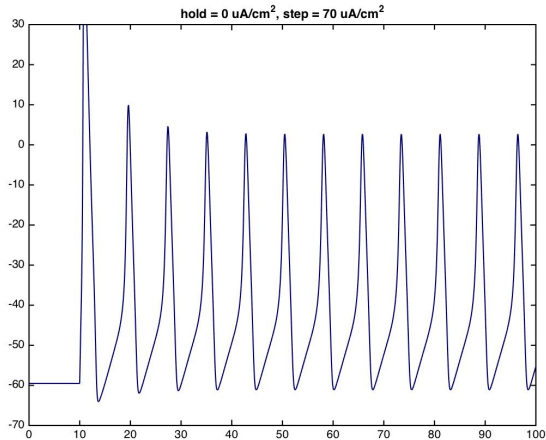


Figure : HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

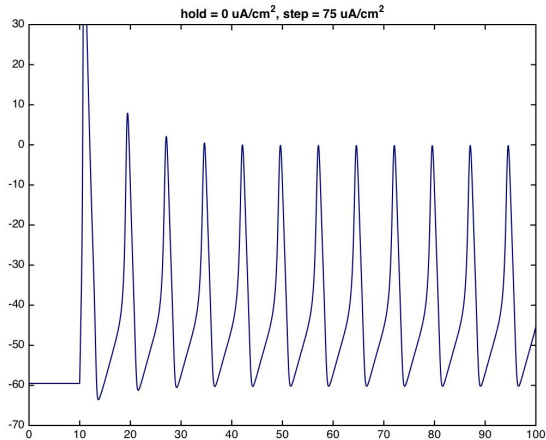


Figure : HH Models step current response starting at 0 $\mu\text{A}/\text{cm}^2$

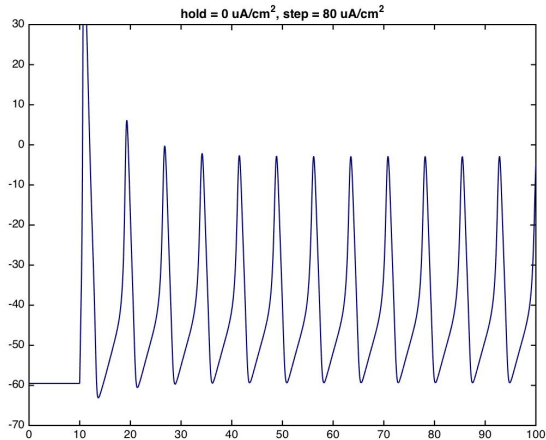


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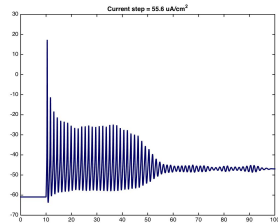
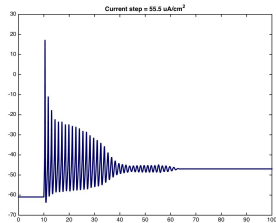


Figure : Incorrect behavior due to low precision

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.