

How Internodal Spacing Modulates Saltatory Information Flow

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October 5, 2024

Abstract

In this note, the authors simulate action potential propagation in an axon under different conditions of internodal spacing and find that this plays a critical role in information propagation.

We modify the model in [1] so that the internodal spacing is not fixed. In any biological system the internodal spacing will show slight variations from nodal pair to nodal pair. In this note we exaggerate these differences and study a few different types of internodal spacing profiles. These include: linear growth, exponential growth, exponential decay and so on. The figures below are self explanatory. Each shows the voltage on the vertical axis and time on the horizontal axis. Each shows one or more nodal voltage profiles for the corresponding internodal spacing profile.

References

- [1] Aman Chawla, Salvatore Morgera, and Arthur Snider. On axon interaction and its role in neurological networks. *IEEE/ACM Transactions on Computational Biology and Bioinformatics*, 2019.

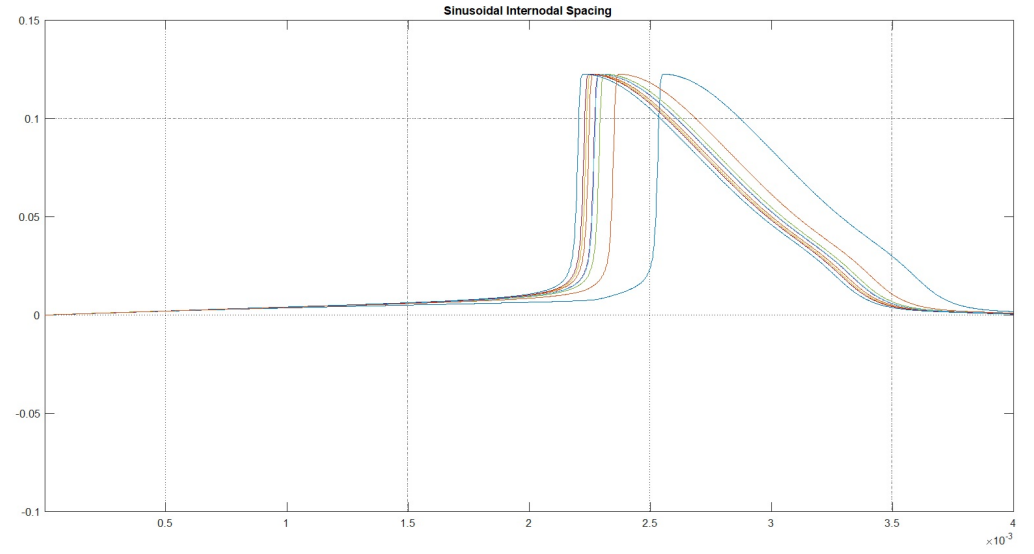


Figure 1: Sinusoidal.

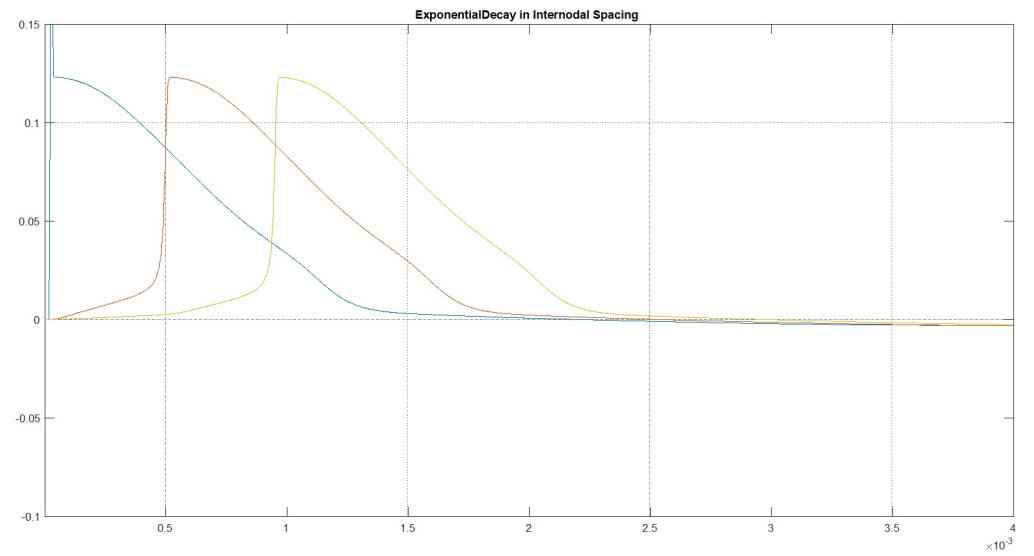


Figure 2: Exponential Decay.

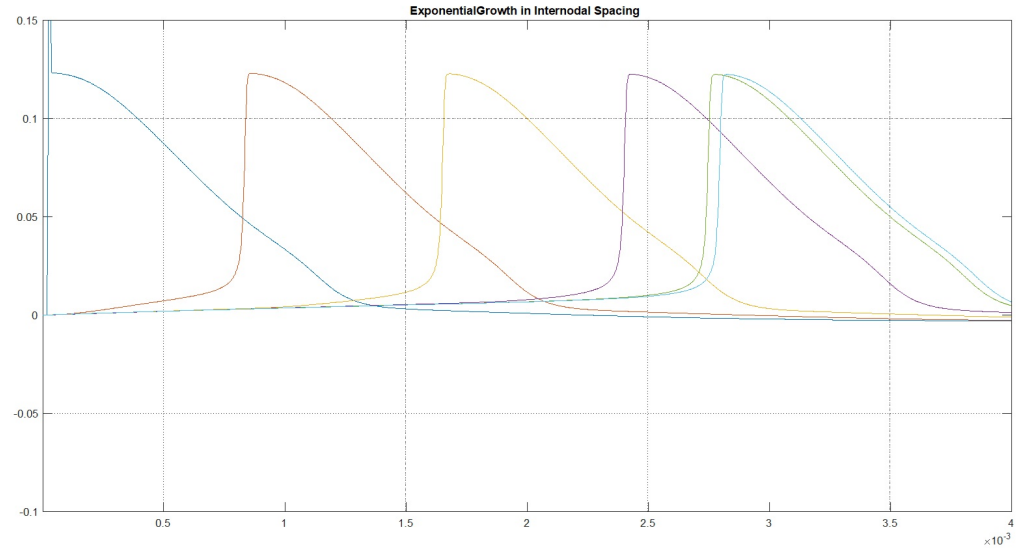


Figure 3: Exponential Growth.

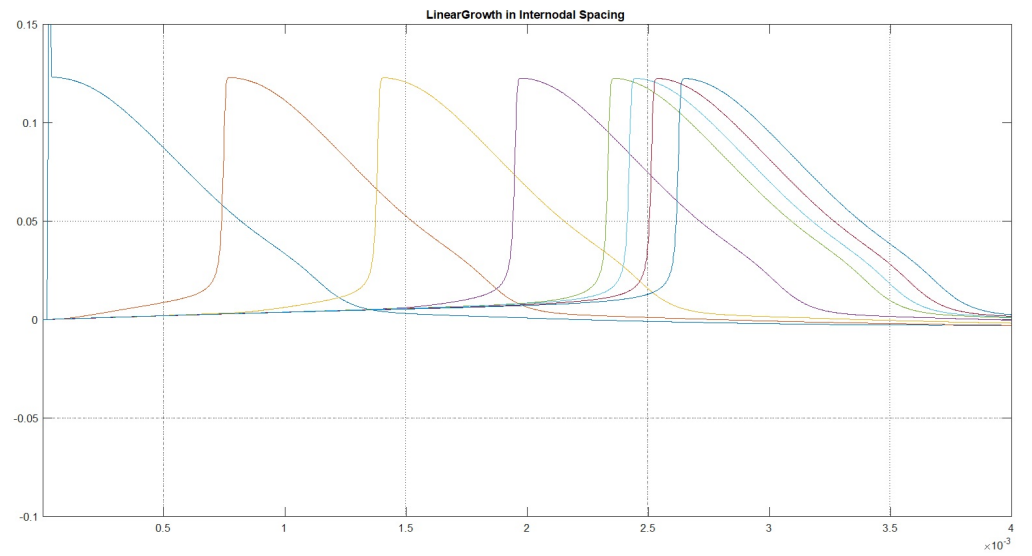


Figure 4: Linear growth.

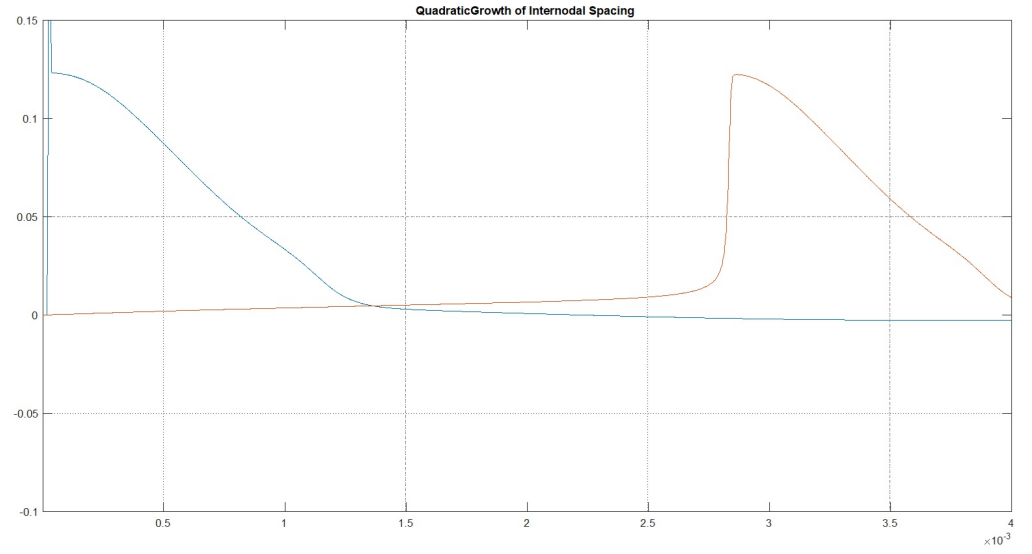


Figure 5: Quadratic Growth.

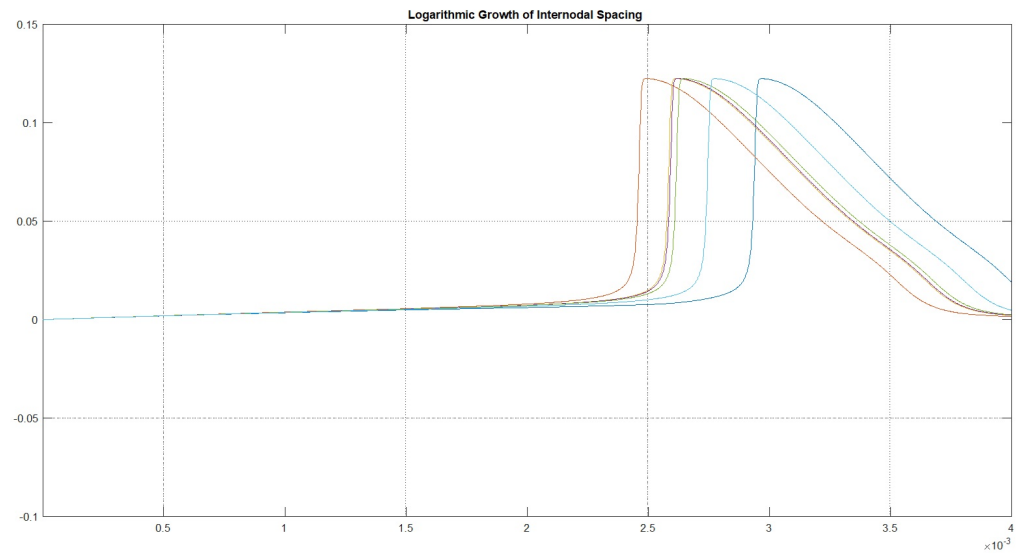


Figure 6: Logarithmic growth.

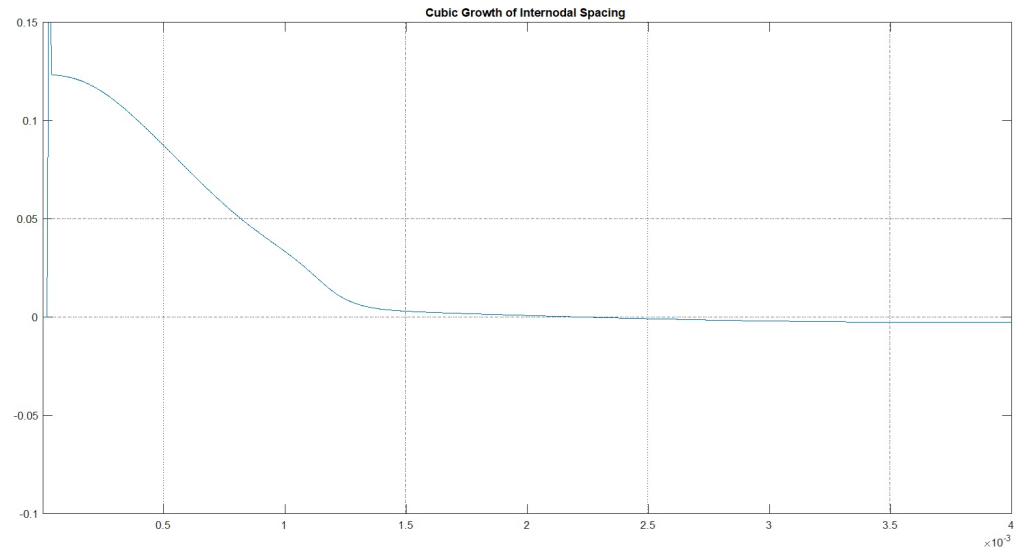


Figure 7: Cubic growth.

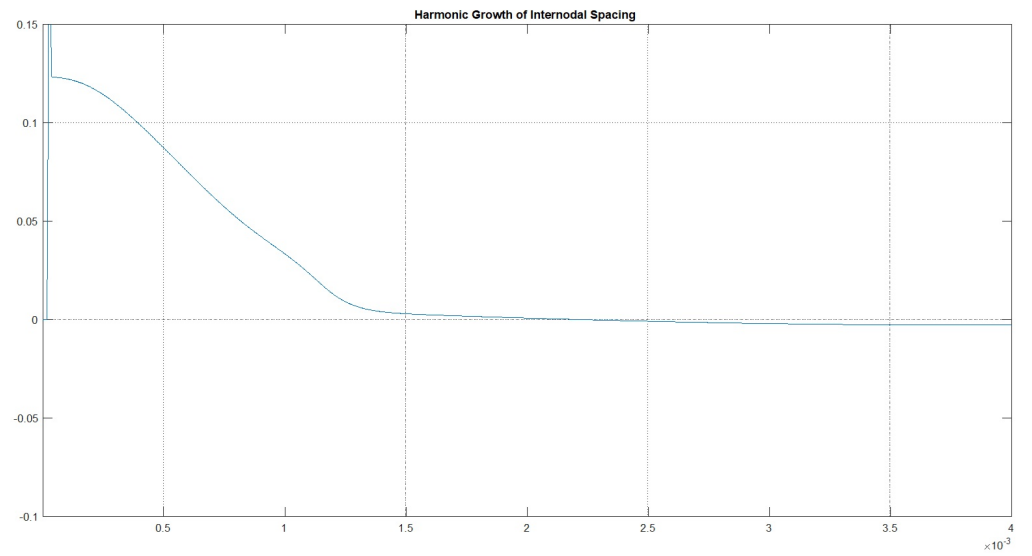


Figure 8: Harmonic growth.

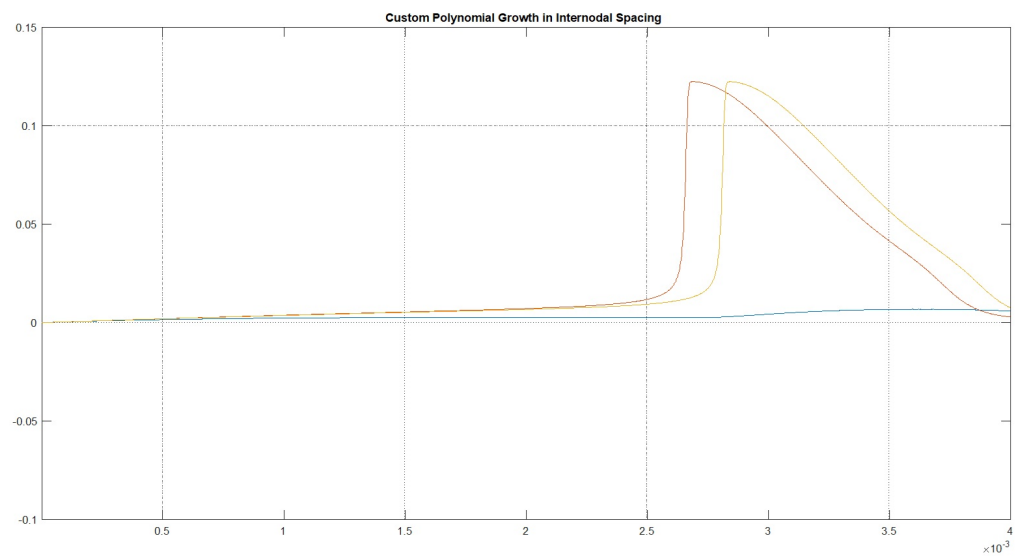


Figure 9: Custom polynomial growth.