Toy Model #4

The equations that define the simple Toy Model are described in Equations 1 and 2.

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|  |  | (1)  (2) |

Then with diffusion added Equations 1 and 2 become 3 and 4 as follows;

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|  |  | (3)  (4) |

Where α and β are variable parameters

# Results 1

Due to there being two parameters it is important to view the interaction between the two. First if you hold α constant and vary β:

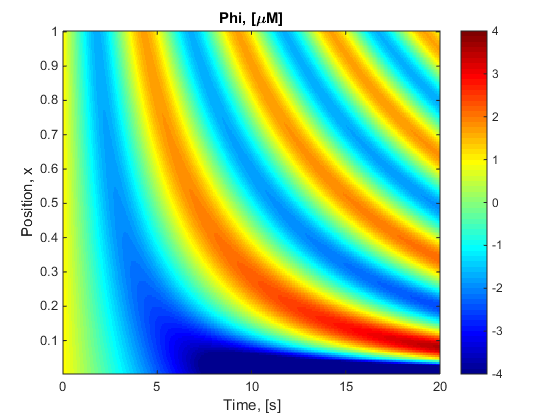
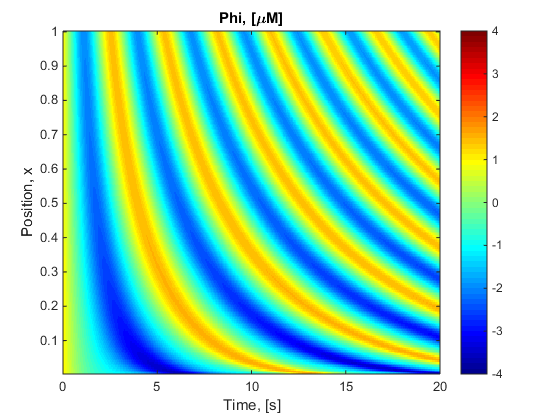
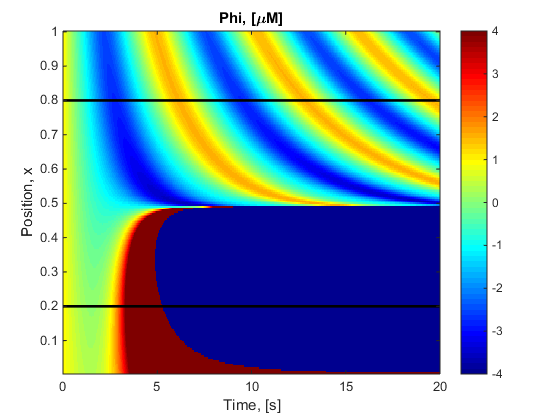
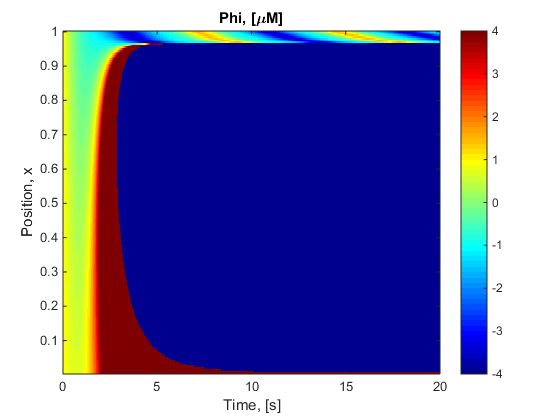
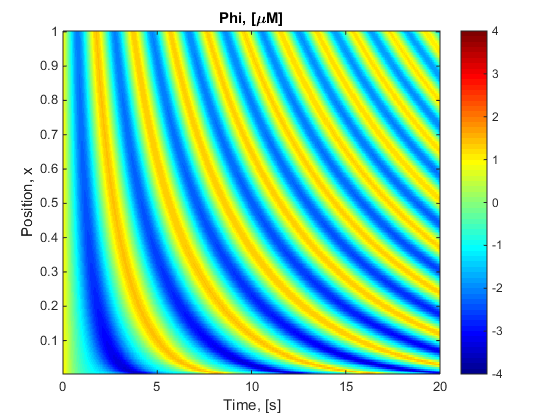


Figure 1: Holding α constant at 0 and varying β linearaly between {0,1}

From here α was changed to 0.5 and again varied β. For Figure 2 the scale has been fixed {-4,4} and thus in the dark blue region which heads to negative infinity is not viewed.



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| Figure 2: Holding α constant at 0.5 and varying β linearaly between {0,1} |  | Figure 3: Holding α constant at 0.5 and varying β linearaly between {0.5,2} |

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| Figure 4: Holding α constant at 1 and varying β linearaly between {0,1} |  | Figure 5: Holding α constant at 1 and varying β linearaly between {0.98,2} |

Next holding Beta constant and varying alpha had an equal but opposite effect

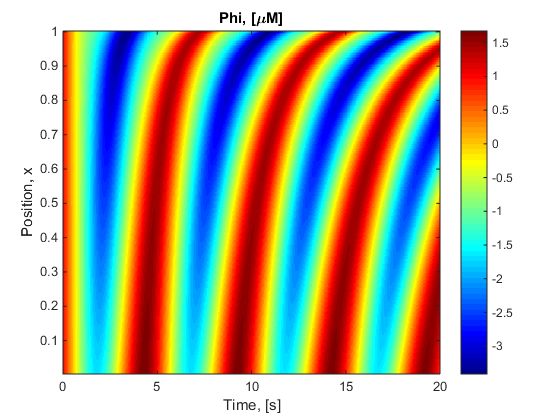


Figure 6: Holding β constant at 1 and varying α linearaly between {0,1}

# Results 3

Creating zero osculation’s; to view the diffusion it is important to have a region that initially had no osculation’s. To do this the rate of changes of Ф and V to zero for the initial conditions (Ф = V = 1).

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Figure 7 shows Beta and alpha varying over x to obtain zero osculating.

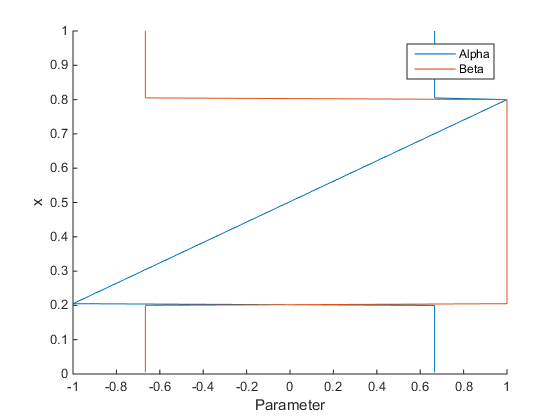
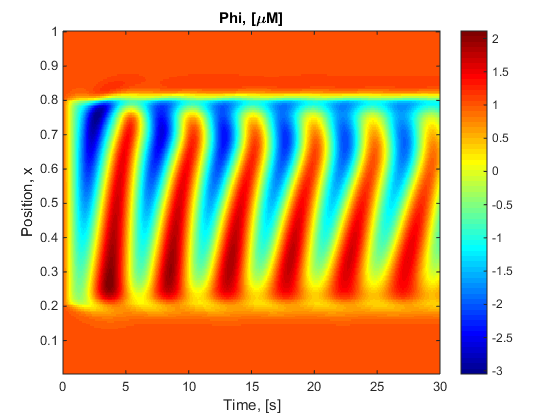
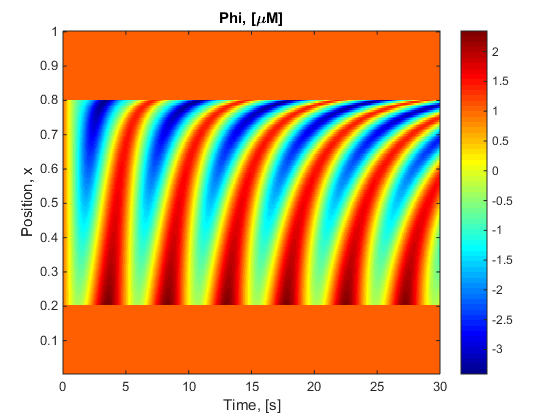


Figure 7: Alpha and Beta varying over x to obtain zero osculation’s between 0<x<0.2 and 0.8<x<1.



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| Figure 8: α and β determined by Figure 7 and Equations 1 and 2; Zero Diffusion |  | Figure 9: α and β determined by Figure 7 and Equations 3 and 4; Simple Diffusion 200e-6 |

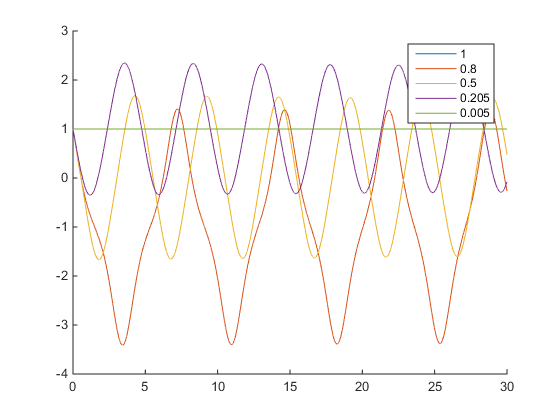


Figure 10: A few x points of Figure 8 potted over time.

# Results 4

Changing the diffusion constant, D.

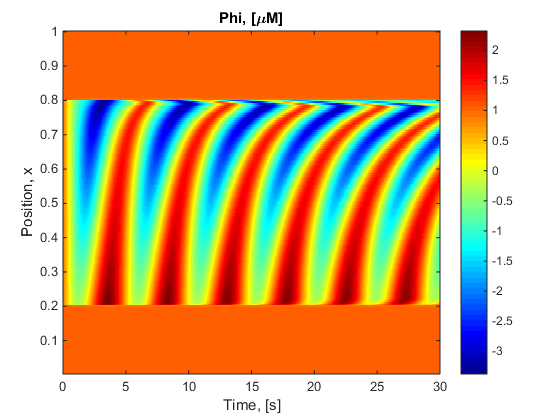
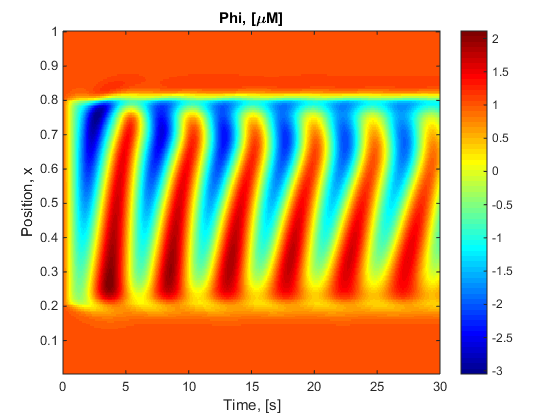
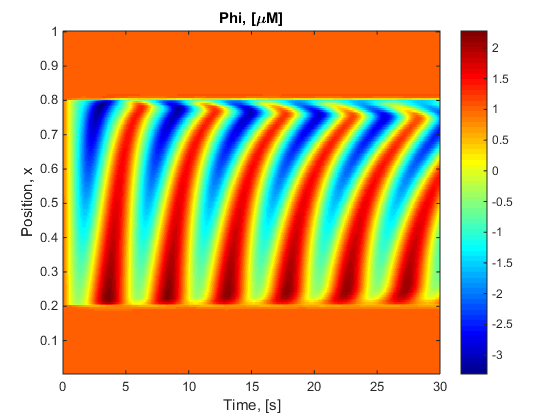
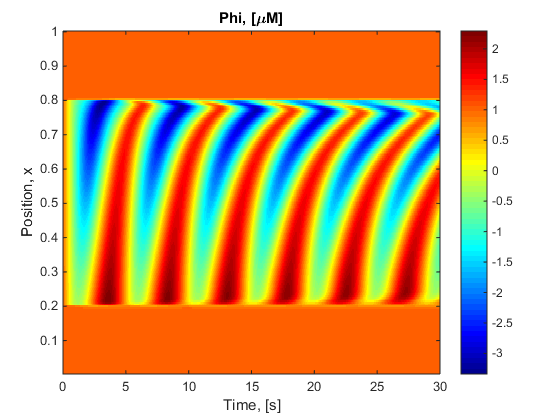
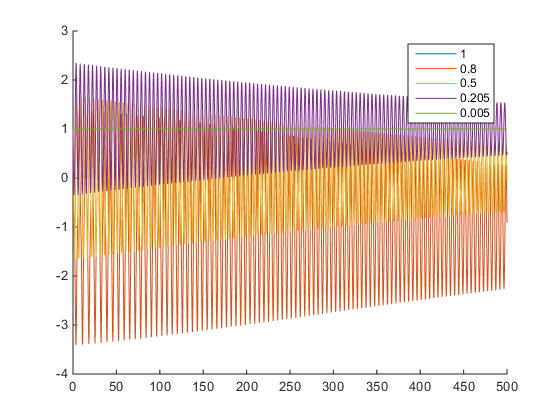
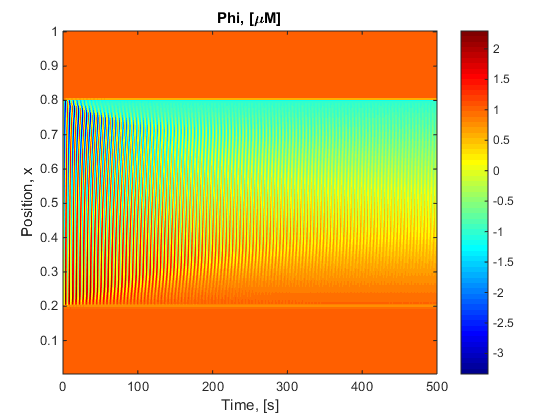
 

Figure 11-14: D = {1e-6, 5e-6, 10e-6, 100e-6}

# Results 5

Simulated over a long period of time



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| Figure 15: Diffusion, D = 5e-6 and long time, t={0:500} |  | Figure 16: x points from Figure 15 plotted over time. |

# Discussion

* Increasing alpha from 0 to 1 shows that there is an increasing instability in the results.
* At low diffusion constants the waves do not protrude into the unexpected region
* however they do form the triangle pattern of diffusion.