Circadian Clock Paper summary

# Goal: Summarize non-dimensionalization of SNF model and compare new and old manuscript

# Nondimensionalization

Original dimensional form of SNF

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and

*β*1 = *β*2 = *β*3 = *β*

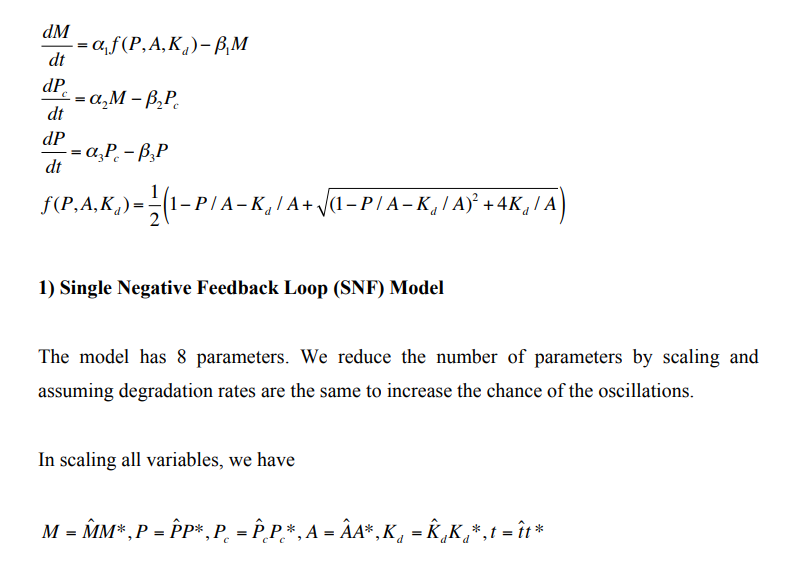
|  |  |
| --- | --- |
| Parameter | non-dimensionalization |
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Variables denoted with ‘hat’ are dimensional with unit. Variables w/o ‘hat’ are dimensionless.

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The non-dimensionalization method is the same as the previous manuscript in the supplemental information.

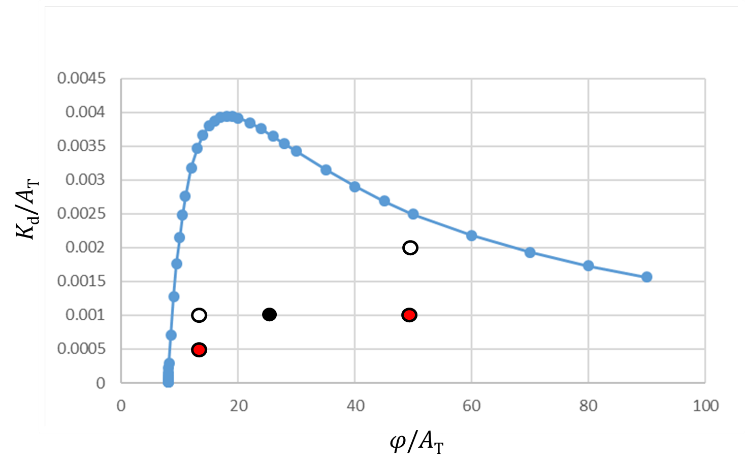
I also checked 2012 Kim Forger’s non-dimensionalization, which is the same as shown below.



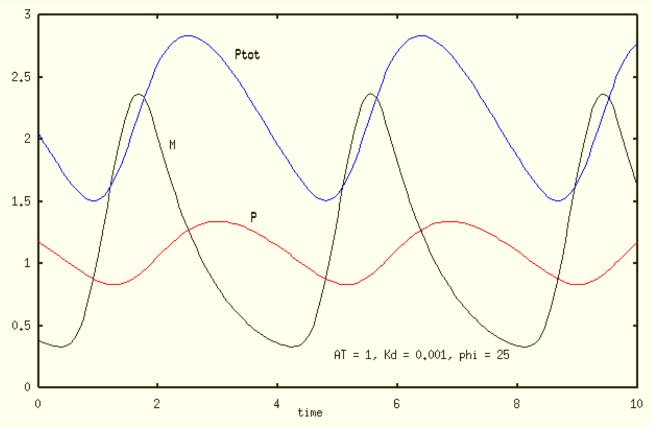
# Analytical analysis of the requirement of circadian rhythm

The major update of the manuscript is the analytical analysis of the requirement of parameter values.

To have a Hopf bifurcation, the condition must be met for a equality of and .



From the plot of the function, the black dot corresponding to homozygous WT is located. The value of 3 parameters would be *A*T = 1 (arbitrarily) and *K*d = 0.001, *φ* = 25



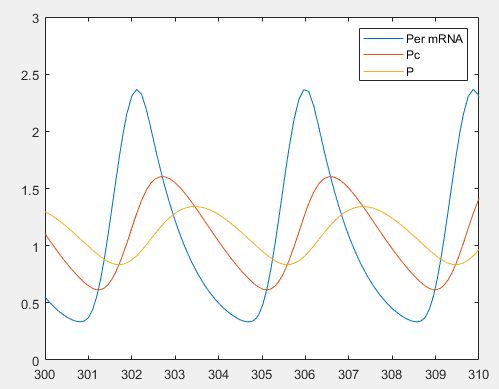
The dynamics of the model SNF 0L3 with these parameters shows circadian oscillation for P and Ptot, but the black curve corresponding to *PER* mRNA is not very sinusoidal.

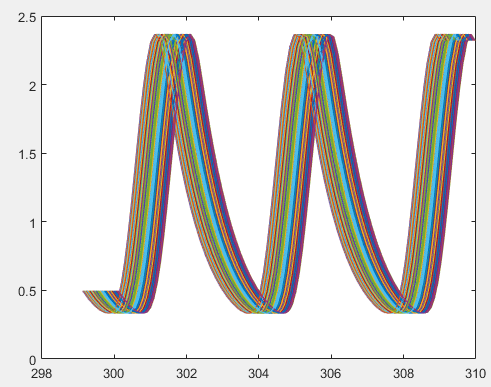
# Problem of original SNF model:

It seems that *K*d/*A*T ≤ 0.001 is needed for circadian rhythm. With estimate of *Â*T ≈ 33 nM from experimental data, . Together with new information, a new estimate is that , or in dimensionless terms, 0.3 < *K*d < 3.

Also, Per mRNA time trajectory becomes less sinusoidal if At becomes larger, which is not discussed in the previous manuscript.

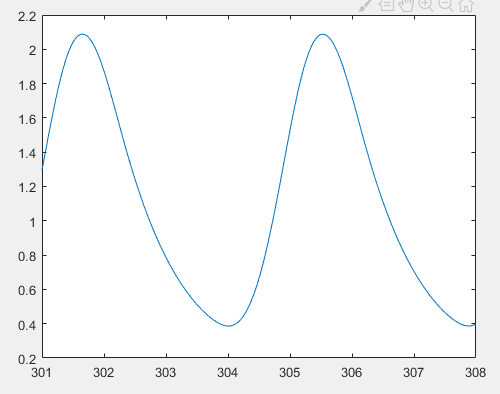
# Test of the symmetry of a population of asymmetrical oscillation

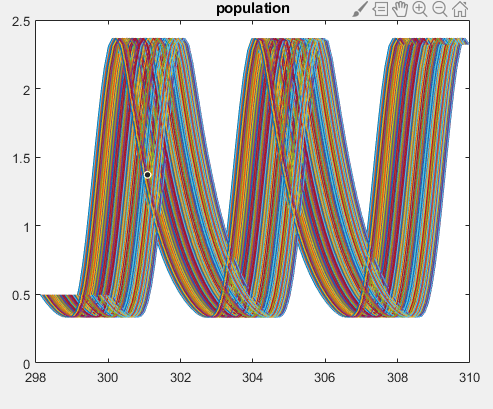




Random phase shift t~[0,1] hour

average





average

