Codes to model stochastically the CheY-P molarity in the neighbourhood of *E. coli* flagella motors

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1 Abstract

This dataset includes the C codes to model stochastically the CheY-P molarity in the neighbourhood of flagella motors [1]. We use the approach proposed by H. Risken [2] to numerically solve the Langevin equation (1) of reference [1]. There are two versions of the same code for different purpose. Code 1 is used to obtain the *Run* & *Tumble* times (or CW & CCW for one flagellum) for the RTD and TTD. Code 2 is used to obtain *Tumble bias* (or *CW bias* for one flagella) for different steady molarity μ.

2 Usage Notes

We recommend using open source code blocks to compile and run the program. The data are saved in .dat files using CSV format. In reference [1] Figures 3 and 4 are obtained with Code 1, and Figures 5, 6, and 7 with Code 2. We recommend to test random generator and compiler with Code 1, through the stationary probability density function (SPDF) for the CheY-P molarity for one flagellum, which can be compared to analytical results for different μ values. The SPDF of the Fokker-Planck equation (2) of reference [1] is:

$$p_{\mathrm{ST}}(c) = N \, \exp\Big[c^{\beta} \Big(-\frac{c^2}{2+\beta} + \frac{c\,\mu}{1+\beta} \Big) \Big] \tag{1}$$

where N is the normalization constant. Figure 1 show the plots of equation (1) and the numerical results using Code 1. The readme files are:

ReadMeForCode1.txt
ReadMeForCode2.txt

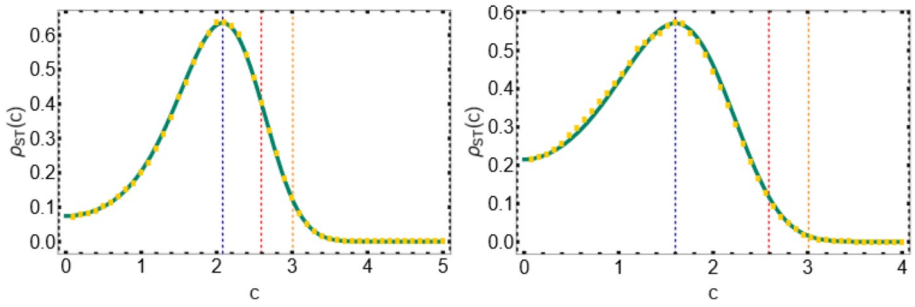

Figure 1: Both plots show equation (1) in green, with μ value used in blue dashed line, and the thresholds c_{oi} and c_{io} in red and orange dashed lines, respectively. Left: SPDF for $\mu = 2.08$ obtained with Code 1 in yellow rectangles. Right: SPDF for $\mu = 1.6$ obtained with Code 1 in yellow rectangles. N is the normalization of the PDF and $\beta = 1$.

3 Files

Code1.zip
Code2.zip

Acknowledgements

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4 References

[1] G. Fier, D. Hansmann, and R. C. Buceta (2019), A stochastic model for CheY-P in the neighbourhood of *E. coli* flagella motors: Shifts in chemotactic response induced by the flagella number, bioRxiv 831990; DOI: https://doi.org/10.1101/831990

[2] Risken H (1989) *The Fokker-Planck equation: Methods of solution and applications.* Springer-Verlag.