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A Lattice Boltzmann Method for modeling the oscillation of Min proteins: Oscillation pattern due to the initial copy of MinD and MinE

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Summary

Understanding of Bacteria cell division is essential for an understanding of microorganism as well as the origin of the life. Particularly, in cell division process of *E. coli*, Min proteins (MinD and MinE) play crucial roles to regulate the dividing dynamics physically via their oscillatory dynamics from pole to pole. In this work, we have developed a numerical scheme based on the mesoscopic Lattice Boltzmann Method (LBM) to simulate the coarse-grained coupled reaction-diffusion equations model used to describe the MinD/MinE interaction in two dimensions. Biologically, we have focused on investigating how the protein copies affect the oscillation patterns as well as cell division. Interestingly, numerical solutions reveal that the oscillation pattern and some physical properties become altered considerably depending on "Min protein crowd"'. This finding may suggest that the failure in cell dividing may be due to being abnormal in protein regulations or expression to control Min protein copies. Good agreement between the experimental and numerical results is found and discussed.

keywords: Mesoscopic modeling, Lattice Boltzmann Method(LBM), Initial copy of Min proteins, Oscillation pattern, Cell division

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