

Biofilms as active sheets and filaments

Ana Carpio (UCM), Elena Cebrián (UBU)

Rafael González-Albaladejo (UCM)

Bacterial biofilms often spread forming sheets on surfaces and filaments in fluids. Such sheets and filaments undergo instabilities, like wrinkles and loops, frequently observed in elastic plates and threads. By modeling biofilms as active plates or threads, we are able to reproduce experimentally observed patterns [1, 2, 3]. Biofilm deformation and spread can be described by nonlinear elastic or poroelastic models involving nonlocal terms representing cell activity and the interaction with the environment. Such terms are obtained averaging information provided by agent based models of bacterial behavior [4]. We consider cellular automata and immersed boundary approaches to individual cell dynamics [5, 6]. Numerical simulations show that the models capture observed qualitative features such as accelerated spread and wrinkle formation in sheets or loops in filaments.

References

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