2014 Distinguished Applied Math. Lecture
Model-aided Understanding of Self-organized aggregation

主講人

Professor Masayasu Mimura

Meiji Institute for Advanced Study of
Mathematical Sciences, Meiji University, Japan

榮譽與獎項(僅例部分)

1990 invited speaker at ICM
1991 invited speaker at ICIAM
1996 vice-president of Japan SIAM
2002 President of Japan SIAM
2008 中華民國數學會特殊貢獻獎
2012 President of Japanese Society of Mathematical Biology

摘要

Over the past ten years, our understanding of how spatio-temporal patterns in far from equilibrium systems has been gradually deepened. Collaborative works of experimental and theoretical studies have discovered the mechanism how complex patterns were generated in biological systems. One of the great contributors is a British mathematician, logician, computer scientist and mathematical biologist, Alan Turing. He emphasized that genetics does not always reveal the occurrence of such patterns and even systems are simple, they may generate ordered as well as chaotic patterns in a self-organized way. In this talk, we are concerned with self-organized aggregation in biological individuals, which is caused by chemical pheromones. First, in a micro-scopic level, we discuss a macroscopic cross-diffusion model for self-organized aggregation of individuals that include directed movement due to an aggregation pheromone. We then propose a hybrid model which is related to macro-scopic and micro-scopic descriptions. This model assumes that each individual responds to pheromone concentration and moves by two-mode simple symmetric random walks. Our goal is to link these two models by using the singular limit and the hydrodynamic limit procedures. It shows that even though the movement of individuals is not directed, two-mode simple symmetric random walks and effect of the pheromone result in self-organized aggregation.

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