Semester Thesis

INSTITUTE OF COMPUTATIONAL SCIENCE

Computing Growth and Form

Simulate growth of cells and organisms using discrete and continuum computational models

The development of living organisms is directed by the interaction and individual growth of cells. This development is determined by synergies acting across a multitude of spatial and temporal scales. The study of these processes is one of the cornerstones in the emerging field of Systems Biology providing an array of experimental, theoretical and computational challenges.

It is possible that similar to the problem itself a synergetic approach may be required for its solution. The process of synthesis by a collection of interacting, synergetic units constitutes a fundamental form of computation : **emergence.** The development of complex forms and patterns found in living organisms (**morphogenesis**), provides many striking examples of emergence. Simulation plays an essential role in the study of morphogenesis as first pioneered by Turing in 1952.

In this thesis we will study patterns of morphogenesis through numerical simulations and visualisations. Of particular interest will be the development of computational models that identify the geometrical transformations and strcutures on the seminal book of **D'Arcy Thompson : On Growth and Form.** The computational models will include continuum agent-based models. Visualisation of the shapes and model interactions is and essential part of this project

PREREQUISITES

Good Programming Skills
Desire to Learn and Improvise
Independent worker

CONTACT

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CSE LAB

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In the CSE Lab we combine computational methods, computer science tools and domain specific knowledge to solve scientific and Engineering Problems in areas such as Fluid Mechanics, Nanotechnology and Life Sciences.The core computational competences of our group are in particle methods and in stochastic optimization techniques. Motivated by challenges in application fields, we focus on identifying the common elements among computational techniques and on formulating common methodological, algorithmic and software structures that facilitate their further development.