Continuous versus Discrete: some topics with a regard to membrane computing

Adam Obtułowicz
Institute of Mathematics, Polish Academy of Sciences
Warsaw, Poland

Discretization programs

Fredkin–Sorkin–Wolfram discretization programs of physics via E. Fredkin's digitalization, R. D. Sorkin's causal sets, and S. Wolfram's cellular automata approach give rise to a question:

Question

Does the discretization mean a lost (or eventually how to find counterparts) of classical quantitative properties of continuously (with respect to time among others) treated processes like

- stability property,
- asymptotic behaviour (i.e. tending of process trajectories—the solutions of some differential equations to some possibly regular curves),
- irregular behaviour:
  - chaos[1],
  - perturbations.

[1] D. A. Hill, *Chaotic Chaos*, Math. Intelligencer 22(3), 5, 2000

Answer

Some (partial) answer to this question is contained in:

- characterization of irregular behaviour of processes represented by large graphs (like causal sets and their Hosse diagrams) in terms of dimensions like fractal dimension,
- the attempts of making the discrete constructs continuous one, like K. Martin and P. Panangaden work of building back space-time manifold from Sorkin like causal order.

Membrane computing

Concerning membrane computing one could:

- represent processes generated by P systems by causal sets like T. Bolognesi represents computational processes of various mechanisms,

then

- approach the causal sets representing processes generated by P systems like in the answer to the main question given above.