Simulating Reversible Computation with Reaction Systems

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Abstract

In the past decades, several natural computing models emerged, capturing computational processes taking place in nature, or simply being inspired by natural phenomena. Reaction systems [1, 2], a recent natural computing framework, is designed to investigate the computational nature of processes driven by interactions between biochemical reactions in living cells. Governed by facilitation and inhibition, reaction systems present a qualitative model where computation moves forward by applying reactions on sets.

In this talk, we study how to introduce reversibility in the framework of reaction systems. As reversibility is an inherent property of many biological and chemical processes, reaction systems present an appealing framework for such studies. After defining what reversibility means in this specific context, we explore the necessary properties of reversible forward computations. In contrast to [3], we also consider the presence of environment-supplied input. This is of particular importance, since reaction systems do not act in isolation, but in interaction with their environment. Combining reversible and interactive computations, bidirectional processes can be simulated by forward-only steps introducing the concept of undo-redo-like controlled reversibility. We conclude by discussing the impact of reversibility on the computational capabilities of the underlying framework.

References

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[3] Aman, B., Ciobanu, G., Controlled Reversibility in Reaction Systems, *Membrane Computing* (2018), 40-53.