DNA Computing - Going Beyond Turing (Invited talk)

Erzsébet Csuhaj-Varjú

Department of Algorithms and Their Applications, Faculty of Informatics,
Eötvös Loránd University

csuhaj@inf.elte.hu

Recently, there has been a growing interest in computing devices that are able to "go beyond Turing", i.e., to compute languages (sets of numbers) which are not recursively enumerable. Red-green Turing machines are examples for these models. A red-green Turing machine is a type of ω-Turing machines on finite inputs with a recognition condition based on some property of the sets of states visited infinitely (finitely) often [5]. The set of internal states of these deterministic machines is divided into the disjoint sets of *red* states and *green* states. An infinite run of the Turing machine is called *recognizing*, if and only if no red state is visited infinitely often and one or more green states are visited infinitely often. A change from a green state to a red state or reversely is called a *mind change*. Red-green Turing machines recognize recognize exactly the Σ_2-sets of the Arithmetical Hierarchy, and every recursively enumerable language can be recognized with a red-green Turing machine with only one one mind change. [5].

The fruitful idea of red-green computation has been extended to other computational models. In [3, 4] connections between red-green Turing/register machines and standard Watson-Crick T0L systems were established. Watson-Crick L systems are computing devices using the paradigm of complementarity known from DNA computing considered in the operational sense [6, 2]; mind change of red-green Turing machines and the turn to the complementary string in Watson-Crick L systems demonstrate conceptual similarity.

In this talk we survey connections between variants of red-green Turing machines and variants of Watson-Crick L systems. In particular, we describe how important characteristics of Watson-Crick L systems can be represented in terms of properties of red-green Turing machines and reversely.

References

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