Journal of Automata, Languages and Combinatorics **4** (1999) 1, 3–16

COOPERATING DISTRIBUTED SPLICING SYSTEMS

CARLOS MARTIN-VIDE

Research Group on Mathematical Linguistics and Language Engineering (GRLMC), *Rovira i Virgili University, Pl. Imperial Tàrraco 1, E-43005 Tarragona, Spain*
e-mail: cmv@nil.fut.es

and

GHEORGHE PĂUN[1]

Institute of Mathematics of the Romanian Academy, P. O. Box 1-764, R-70700 Bucureşti, Romania
e-mail: gpaun@imar.ro

ABSTRACT

We introduce a new class of cooperating distributed H systems which consist of a given set of splicing systems (sets of splicing rules plus sets of axioms), similar in form to the cooperating distributed grammar systems. By applying iteratively the components of such a system (starting from a given initial string), in a sequence which runs nondeterministically, in such a way that a step is considered correctly finished only if no more splicing is possible, we obtain a language. Somewhat surprisingly if we take into account the loose control on the operations we carry out, a characterization of recursively enumerable languages is obtained, by mechanisms as above with only three components. We also characterize the recursively enumerable languages by cooperating distributed H systems with the components containing at most three splicing rules (in this case the number of components is no longer bounded).

Keywords: formal languages, grammar systems, DNA computing, H systems.

1. Introduction

The splicing operation has been introduced in [8] as a formal model of the recombinant behavior of DNA molecules under the influence of restriction enzymes and ligases. The passing from the biochemical reaction of recombination to the abstract operation of splicing is described in [9]. Informally speaking, two DNA sequences are cut by two restriction enzymes and the fragments are recombined such that possibly new sequences are produced. The sites where the enzymes can cut are encoded as pairs $(u_1, u_2), (u_3, u_4)$, and the fact that they produce matching ends is represented by

[1]Research supported by a grant under the Italian National Research Council (CNR) program for visiting professors, 1997, and by the Direcció General de Recerca, Generalitat de Catalunya (PIV), 1997