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ON FORMAL POWER SERIES GENERATED BY LINDENMAYER SYSTEMS

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ABSTRACT

To study power series generated by Lindenmayer systems we define L algebraic systems and series over arbitrary commutative semirings. We establish closure and fixed point properties of L algebraic series. We show how the framework of L algebraic series can be used to define D0L, 0L, E0L, DT0L, T0L and ET0L power series. We generalize for power series the classical result stating that D0L languages are included in CPDF0L languages.

Keywords: L system, formal power series, Lindenmayerian algebraic series.

1. Introduction

Formal power series play an important role in many diverse areas of theoretical computer science and mathematics, see [1, 17, 19, 20, 21]. Formal power series generated by Lindenmayer systems were defined in [2, 4, 15, 12, 13]. In this paper we continue the study of these series. We again use the framework of [17].

In [13] L algebraic power series were studied. By definition, a power series is L algebraic if it is a component of the least solution of a system of polynomial equations involving finite substitutions. Hence, L algebraic series are obtained by multidimensional morphic iteration. In [13] it is always assumed that the basic semiring is commutative and ω-continuous. In [4] arbitrary commutative semirings are considered but the main interest lies on L algebraic series defined by a single equation. In this paper we combine the approaches of [4] and [13] by studying L algebraic series over arbitrary commutative semirings. To generalize results of [13] in this setting we have to replace the fixed point approach applicable in the case of ω-continuous semirings by the limit approach which can be used over any semiring.

A brief outline of the contents of the paper follows. Section 2 contains the definitions of L algebraic systems and various classes of L algebraic series. In Section 3 we

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