▸ IVO DÜNTSCH, IAN PRATT–HARTMANN, *Complex Algebras of natural Numbers.*
Department of Computer Science, Brock University, St Catharines L2S 3A1, Canada.
*E-mail*: duentsch@brocku.ca.
School of Computer Science, University of Manchester, Manchester M13 9PL, U.K..
*E-mail*: ipratt@cs.man.ac.uk.

Let $\mathbb{N}^+ = \langle \omega, 0, + \rangle$, $\mathbb{N}^{\cdot} = \langle \omega, 1, \cdot \rangle$, $\mathbb{N} = \langle \omega, 0, +, 1, \cdot \rangle$, and $\mathfrak{Cm}\,\mathbb{N}^+$, $\mathfrak{Cm}\,\mathbb{N}^{\bullet}$, $\mathfrak{Cm}\,\mathbb{N}$ be the respective complex algebras. These algebras are closely related to *arithmetic circuits*, introduced in [1]. We investigate the structure of these complex algebras and some of their significant subalgebras, and explore the complexity of their first order and equational theories. In particular we show that the first order theories of these algebras as well as $\mathbf{EQ}(\mathfrak{Cm}\,\mathbb{N})$ are undecidable; furthermore, the equational theories of the smallest subalgebras of $\mathfrak{Cm}\,\mathbb{N}^+$ and $\mathfrak{Cm}\,\mathbb{N}^{\bullet}$ are co–r.e.

[1] P. McKenzie and K. W. Wagner (2003). *The complexity of membership problems for circuits over sets of natural numbers*, **STACS 2003, 20th Annual Symposium on Theoretical Aspects of Computer Science** (Berlin), (H. Alt and M. Habib, editors), Lecture Notes in Computer Science vol. 2607, Springer–Verlag, 2003, pp. 571–582.