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An equational axiomatization for multi-exit iteration. (English. English summary)

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Bergstra, Bethke and Pons investigated the expressive power of variations on standard process description languages in which infinite behaviours are defined by means of Kleene's star operation, rather than by means of systems of recursive equations, and proposed an axiom system for bisimulation equivalence over the language of Basic Process Algebra (BPA) with the original version of the Kleene star operation (BPA*).

The completeness of the axiom system proposed by Bergstra, Bethke and Pons was proved by Fokkink and Zantema. Several notions of process equivalence were axiomatized over languages integrating variations on the Kleene star operation.

Now, not every process defined by using finite state systems of recursive equations can be described, up to bisimulation equivalence, by using only regular expressions. To increase the expressive power of basic process algebras incorporating Kleene star-like operations, the use of k-exit iteration was proposed by Bergstra, Bethke and Pons. Multi-exit iteration allows for the specification of agents that, up to the bisimulation equivalence, are solutions of systems of recursion equations of the form $X_1 = P_1X_2 + Q_1, \cdots, X_k = P_kX_1 + Q_k$, where k is a positive integer and the P_i and Q_i are process terms.

In the present paper the authors present an equational axiomatization of bisimulation equivalence on BPA with multi-exit iteration, and prove its completeness. The paper concludes with an expressiveness hierarchy for the family of k-exit iteration operations.

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