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An equational axiomatization for multi-exit iteration. (English) Zbl 0881.68069

Summary: This paper presents an equational axiomatization of bisimulation equivalence over the language of basic process algebra (BPA) with multi-exit iteration. Multi-exit iteration is a generalization of the standard binary Kleene star operation that allows for the specification of agents that, up to bisimulation equivalence, are solutions of systems of recursion equations of the form

\[ X_1 \overset{\text{def}}{=} P_1X_2 + Q_1 \]
\[ \vdots \]
\[ X_n \overset{\text{def}}{=} P_nX_1 + Q_n, \]

where \( n \) is a positive integer and the \( P_i \) and the \( Q_i \) are process terms. The addition of multi-exit iteration to BPA yields a more expressive language than that obtained by augmenting BPA with the standard binary Kleene star (BPA\(^*\)). As a consequence, the proof of completeness of the proposed equational axiomatization for this language, although standard in its general structure, is much more involved than that for BPA\(^*\). An expressiveness hierarchy for the family of \( k \)-exit iteration operators proposed by Bergstra, Bethke, and Ponse is also offered.

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References: