Logical description of (weighted) parametric component-based systems with (w)FOEIL

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Abstract

One of the key aspects in component-based design is specifying the software architecture that characterizes the topology and the permissible interactions of the components of a system.

We present an extended propositional interaction logic and investigate its first-order level (FOEIL) which serves as a formal language for architectures applied on parametric component-based systems, i.e., systems that consist of an unknown number of instances of each component. Our logic achieves to encode the execution order of interactions, which is a main feature in several important architectures, as well as to model recursive interactions. We state the decidability of equivalence, satisfiability, and validity of FOEIL formulas.

Then, we introduce a weighted FOEIL (wFOEIL), over a commutative semiring, and describe parametric component-based systems and their architectures with quantitative features. We show decidability results for wFOEIL formulas over a (subsemiring of a) skew field.