

# Nominal SOS

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Concepts of names, variables, meta-variables, and name abstraction (binding) are the bread-and-butter of contemporary process algebras and calculi. For example, in the  $\pi$ -calculus [12], names are first-class citizens and the whole calculus is built around the notion of passing names among concurrent agents. These phenomena appear also in specifications involving the recursion operator, the infinite sum operator, and the time-integration operator (cf. [12], [14], and [2], respectively).

Structural Operational Semantics (SOS) [13] has been widely used to give operational semantics to formalisms and process calculi. Given the presence of names and binders in different formalisms and calculi, it is useful to accommodate these (often informal) notations inside the SOS framework. A feature of such a framework is that name abstraction may have process meta-variables in its scope. We propose a formal framework for names in SOS, based on the Nominal Techniques of Gabbay and Pitts [7, 15].

Similar work exists in [16] and [5]. The work of [16] is based on the  $FO\lambda^{\Delta\nabla}$  by Miller and Tiu [10] and extends the *tyft* format of [9] with names and binders. The work of [5] is based on the categorical model of abstract syntax with names and binders as proposed by [4, 6] and extends the *de Simone* format of [3] by adding the support for names.

Apart from the fundamental differences stemming from the underlying treatment of names and binders, our framework extends that of [5] and [16] with negative premises, and that of [5] with arbitrary source terms for the premises.

Following the SOS tradition [1] we also introduce congruence rule formats for Nominal SOS. We extend the *ntyft* format of [8] with names and binders and then add more syntactic ingredients. We further study the addition of equational specification, or structural congruences as advocated by Milner [11, 12], to the operational framework with names and binders.

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