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A relational semantics for parallelism and non-determinism in a functional settling. (English summary)

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A reflexive object in a category built on sets and relations is proposed as a denotational model for the concurrent lambda-calculus.

Concurrent lambda-calculus is obtained by extending the lambda-calculus with parallel composition (of terms) and non-deterministic choice (between terms). A suitable notion of head-reduction is given to define the operational semantics, by associating with each term a 'generalized' head normal form which is a set of multisets of terms whose head subterms are variables. Roughly speaking, the operational value of a term is the collection of all possible outcomes of its head reductions. When the head subterm is $M + N$ (may non-deterministic choice) then the head reduction goes on by choosing either M or N. When the head subterm is $M \parallel N$ (must parallelism) then the head reduction forks. Clearly, the calculus is nonconfluent and nondeterministic.

Let MRel be the category of sets and relations built using the finite-multiset comonad. Albeit MRel has not enough points, it is known that its reflexive objects are lambda-models. A particular extensional reflexive object D of MRel is considered and endowed with two additional operators which turn it into a semiring. This domain is used as the target of the denotational interpretation. The model is proved to be sensible in a suitable way and the adequacy is proved with respect to the contextual preorder induced by the operational semantics. Last, it is shown that the model is not fully abstract. *Luca Paolini*

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Note: This list reflects references listed in the original paper as accurately as possible with no attempt to correct errors.