

## The subobject classifier of the category of functional bisimulations

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**Abstract.** We show the existence of subobject classifier in the category of nondeterministic dynamical systems and functional bisimulations.

*Key words:* nondeterministic dynamical system, functional bisimulation, coalgebra, subobject classifier, dense.

### 1. Introduction

In [8], we studied the category  $\mathcal{NDyn}$  of nondeterministic dynamical systems whose morphisms are functional bisimulations.

A nondeterministic dynamical system is a labelled transition system whose label set has only one element. A functional bisimulation is a map between transition systems. The main results of [8] are the following.

- The category  $\mathcal{NDyn}$  is an autonomous category, i.e., monoidal closed.
- There exists a subobject classifier.

The monoidal closedness was shown by constructing  $\mathcal{NDyn}$  objects via the presheaves over the category  $Tree$ , where the  $Tree$  is a small, dense subcategory of  $\mathcal{NDyn}$ . On the other hand the existence of the subobject classifier was proved by using the theory of hypersets.

In this paper, we prove the existence of subobject classifier in  $\mathcal{NDyn}$  by using the construction via presheaves over  $Tree$  in the same way as the proof of monoidal closedness in [8]. The proof uses a general lemma about presheaf categories, which is given in [10].

As we remark later,  $\mathcal{NDyn}$  is a category of coalgebras for finite powerset functor without empty set. We can brush up the technique which is used in this paper, to an existence theorem [7] of subobject classifiers in categories of coalgebras by using accessible category theory, which led to another existential proof [3] in the context of topos theory.

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