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Towards a homotopy theory of higher dimensional transition systems

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(Submitted on 3 Nov 2010)

We proved in a previous work that Cattani-Sassone's higher dimensional transition systems can be interpreted as a small-orthogonality class of a topological locally finitely presentable category of weak higher dimensional transition systems. In this paper, we turn our attention to the full subcategory of weak higher dimensional transition systems which are unions of cubes. It is proved that there exists a left proper combinatorial model structure such that two objects are weakly equivalent if and only if they have the same cubes after simplification of the labelling. This model structure is obtained by Bousfield localizing a model structure which is left determined with respect to a class of maps which is not the class of monomorphisms. We also prove that two weakly equivalent higher dimensional transition systems are bisimilar and that the higher dimensional transition systems corresponding to two process algebras are weakly equivalent if and only if they are isomorphic. The appendix contains a technical lemma about smallness of weak factorization systems in coreflective subcategories which can be of independent interest. This paper is a first step towards a homotopical interpretation of bisimulation for higher dimensional transition systems.

Comments:	42 pages
Subjects:	**Category Theory (math.CT)**; Algebraic Topology (math.AT)
MSC classes:	18C35, 18G55, 55U35, 68Q85
Cite as:	**arXiv:1011.0918v1** [math.CT]

Submission history

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