Generalized homotopy groups in categories with a natural cylinder

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H.J. Baues defines in his book "Algebraic Homotopy" the concept of "Category with a Natural Cylinder"; his definition requires the existence of initial object, conservation of it by cylinder functor and that objects be cofibrant. The latter is a necessary condition for the "Relative Cylinder Axiom".

The concept of Generalized Homotopy can be obtained by suppressing these conditions since the relative cylinder axiom can be described in other way. Pointed categories and therefore suspension functor are used for the construction of homotopy groups. In this case there is a 0-morphism.

The aim of this paper consist to define homotopy groups relative to a cofibration without the use of pointed categories or 0-morphism, that is homotopy groups relatives to a cofibration based on any morphism.

Exact sequences of these groups are built. Moreover, classic homotopy groups based on the 0-morphism and exact sequences of them are a particular case of the generalized homotopy groups and their sequences.

The suppression of the conditions above mentioned together with the construction of generalized homotopy groups and exact sequences of them in a non pointed category gives a more general theory.

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