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Decorated Feynman Categories.

The combinatorial structure of graphs provides a basic tool in describing and studying structures and relations. For instance, graphs can be used to capture interactions between individuals in a network, bonds between atoms in a molecule, or the behavior of subatomic particles.

Graphs are also useful in illustrating algebraic structures by encoding generators, relations, and operations. Also, thickening a graph gives rise to a surface —a common procedure— and is thus a part of many areas of geometry. Often one graph alone does not suffice to capture the entire structure and a whole class together with decorations, relations, and operations is needed.

Feynman categories provide the natural context and rules for an analysis of these ideas. As such they generalize operads, a known tool in algebraic topology, but are more flexible and basic. Moving from the broad framework to more particular cases, one can start decorating the Feynman categories to model specific situations. In this talk we examine the idea of a Feynman category decorated by extra data, which in technical terms is given by a functor. This enables us to capture several known constructions, such as cyclic or up-to-homotopy algebras or string topology operations, and produce new natural concepts. (Received September 21, 2015)