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Why find cancelation free formula for antipode?

[Joint work with Carolina Benedetti]

Given a family of combinatorial objects we often have an associated graded Hopf algebra. Such algebraic structures encode the associations and decompositions of the objects we study. The antipode is a map from the Hopf algebra into itself that is defined recursively and is difficult to compute in general. Is it worth it to find a cancelation free formula for it?

We start with the Hopf algebra of graphs and show the cancelation free formula of Humpert and Martin for its antipode. We will see that such formula gives a structural understanding of certain evaluations of the combinatorial invariants for graphs. In particular we recover very nicely a classical theorem of Stanley for the evaluation of the chromatic polynomial at -1 .

We then give a general framework where we systematically obtain cancelation free formulas for antipodes. More precisely, we define the notion of strongly linearizable Hopf monoids and show how to get cancelation free formula for antipodes in those cases. This allows us to obtain a cancelation free formula many of the combinatorial Hopf algebras in the literature and more.