Introduction to polynomial functors

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Abstract:

This will be a general introduction to the notion of polynomial functors, starting from their invention by Eilenberg and MacLane in the 1950s. After discussing how they used this idea to calculate homology groups of Eilenberg-MacLane spaces, I will talk about subsequent extensions of their concept of polynomial functor, including two general methods — one recursive, one via "cross-effects" — of defining the degree of a functor taking values in an abelian category.

Polynomial functors often appear in two different but related settings.

- One setting is as the homology (or another algebraic invariant) of the objects of interest, such as in Eilenberg and MacLane's original setting, as well as in the much more recent theory of FI-modules.
- On the other hand, polynomial functors may also appear as the *coefficients* in homology groups: in this setting, one is interested in the homology of a family of spaces or groups, with respect to a corresponding family of local coefficient systems that assemble into a polynomial functor (in this context polynomial functors are more commonly referred to as *twisted coefficient systems of finite degree*).

I will describe some examples of each setting, to give a flavour of what can be done with polynomial functors. An example of the second setting — homological stability for configuration spaces with respect to finite-degree twisted coefficient systems — was the topic of a previous talk at the GeMAT seminar.

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