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Operad structures in the abelian functor calculus tower

This is joint work with Brenda Johnson and Sarah Yeakel.

In 2005, Ching showed that the derivatives of the Goodwillie tower of the identity functor of spaces form an operad. This implied that the derivatives of all homotopy functors have extra algebraic structure, and was used most notably by Arone and Ching to show that the Goodwillie derivatives satisfy a (higher order) chain rule.

In 2016 Johnson, Osborne, Riehl and Tebbe and I showed that abelian functor calculus (a version of functor calculus established by Johnson and McCarthy) is an example of a cartesian differential category - the type of category which axiomatizes classical calculus. A higher order chain rule followed.

In this talk, I will explain that the derivatives of certain abelian functor calculus towers also form an operad, and explain to what extent this is a result of the fact that the category of abelian categories is a differential category. This is closely related to the work of Cockett and Seely which established a Faà di Bruno formula for differential categories.