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Operads of functors with derivatives

The Goodwillie functor calculus tower is an approximation of a homotopy functor which resembles the Taylor series approximation of a function in ordinary calculus. In 2004-05, several authors observed that the homogeneous layers of certain Goodwillie towers form an operad. Ching first observed that the identity functor of spaces has this behaviour. McCarthy and Minasian observed similar operads for functors of operad algebras which are monoids.

In 2011, Cockett and Seely used the notion of categorical differentiation to construct a Faa di Bruno formula, and an associated category Faa(X), which encapsulates the higher order chain rules for derivatives.

The goal of this talk is to explain why one should expect an operad structure associated to the layers of functor calculus towers from the perspective of ordinary calculus. This is an update of a program of research by Johnson, Yeakel and I which shows that the functor associating a functor of abelian categories to its sequence of derivatives is monoidal. This explains the operads arising from functor calculus towers as a consequences of differentiation.