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Categorical algebra of mapping spaces

One of the longstanding problems in homotopy theory is the question how, for a given space A , one can characterize the class of spaces which are homotopy equivalent to the pointed mapping spaces $\text{Map}_*(A, Y)$. In case where A is an n -dimensional sphere S^n this problem was solved in several ways using the machinery of categorical algebra: operads, PROPs, Segal special *Delta*-spaces, etc. The common feature of all these descriptions is that they detect if a given space X is of a type of a mapping space from S^n using only certain maps between finite products of X . This shows that the mapping spaces $\text{Map}_*(S^n, Y)$ are essentially algebraic objects. The talk will describe how one can try to generalize this approach to describe mapping spaces for spaces A other than S^n and the obstructions that one encounters.

This is a joint project with W. Dorabiala.