

RATIONAL HOMOTOPY THEORY AND KOSZUL DUALITY

GEOFFROY HOREL

Abstract: This series of lectures is meant to be a gentle introduction to the theory Koszul duality and its applications to rational homotopy theory. My plan is to explain the theory of Koszul duality in the operadic context. In general Koszul duality provides a correspondance between algebras over an operad and coalgebras over a cooperad. The cooperad and the operad have to be related by the data of a twisting morphism. The most classical version of this is the bar/cobar duality between associative algebras and associative coalgebras. I will also explain the commutative/Lie duality. This construction plays a fundamental role in rational homotopy theory. It can be used to relate the homotopy groups of a space (which is a Lie algebra under the Whitehead Lie bracket) to the cohomology of the space (a commutative algebra).