

GRADUATE SEMINAR

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Multiplicative structure of the Koszul complex

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Abstract

In homological algebra, the Koszul complex can be used as a tool to find Ext groups. I will mainly focus on its multiplicative structure.

Let k be a field, $P(n) = k[x_1, \dots, x_n]$ the polynomial algebra over k on n generators, and $E(n) = \Lambda_k(x_1, \dots, x_n)$ the exterior algebra over k on n generators. The following fact is “classical”.

1. The Ext-algebra over a polynomial algebra is exterior:

$$\text{Ext}_{P(n)}(k, k) \cong E(n).$$

2. The Ext-algebra over an exterior algebra is polynomial:

$$\text{Ext}_{E(n)}(k, k) \cong P(n).$$

In this talk, I will discuss the first item and how to prove this isomorphism by using the tautological Koszul complex, $P(n) \otimes_k E(n)$.