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Commutative Algebra in the Graded Category with an Application to Equivariant Cohomology Rings.

The Degree of a graded $R$-module $M$ is defined as $\lim_{t \to 1} (1-t)^{\dim(M)} PS_M(t)$, where $PS_M(t)$ is the Hilbert-Poincare series of the module, and $\dim$ is Krull dimension. It turns out that this number has a decomposition from commutative algebra as follows: $\deg(M) = \sum_{P \in \mathcal{D}(M)} \ell_R(M)\deg(R/P)$, where $\mathcal{D}(M)$ is the set of minimal primes of $M$ which have maximal dimension.

The main result of this talk gives a re-interpretation of the sum formula above for equivariant cohomology rings. In this setting, $G$ is a compact Lie group acting on a nice enough topological space $X$, and cohomology coefficients are taken in $\mathbb{Z}/p$. The main result is:

$$\deg(H^*_G(X)) = \sum_{[A,c] \in B_{\text{max}}(G,X)} \frac{1}{|W_G(A,c)|} \deg(H^*_{C_G(A,c)}(c)),$$

where $A$ is an elementary abelian $p$-group of maximal rank, $c$ is a component of $X^A$ (the fixed point set) and $C_G(A,c)$, $W_G(A,c)$ refer to the centralizer and Weyl group respectively of $A$ in $G$.

This work is in the spirit of Daniel Quillen’s series of Annals papers from 1972, *The Spectrum of an Equivariant Cohomology Ring I and II*. An example from the cohomology of groups for an extra special 5-group will be presented. (Received September 26, 2017)