Mathematics > Commutative Algebra

On the Rank of Multi-graded Differential Modules

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A \mathbb{Z}^d-graded differential R-module is a \mathbb{Z}^d-graded R-module equipped with an endomorphism, \delta, that squares to zero. For R=k[x_1,...,x_d], this paper establishes a lower bound on the rank of such a differential module when the underlying R-module is free. We define the Betti number of a differential module and use it to show that when the homology H(D)=ker(\delta)/im(\delta) of D is non-zero and finite dimensional over k then there is an inequality rank_R D >= 2^d.

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