Avramov, Luchezar L.; **Grayson, Daniel R.**

Resolutions and cohomology over complete intersections. (English) Zbl 0994.13006

Eisenbud, David (ed.) et al., Computations in algebraic geometry with Macaulay 2. Berlin: Springer. Algorithms Comput. Math. 8, 131-178 (2002).

From the classical point of view computer algebra systems are satisfactory tools for computing (finite) free resolutions over a polynomial ring. The authors start to investigate infinite free resolutions from a computational point of view. There are several new phenomena when studying asymptotic behaviour of infinite resolutions described in the Betti numbers, like irrationality, irregularity, span and size. These obstructions do not occur when the underlying ring B is a graded complete intersection. The algebra behind this 'miracle' is a theorem of *T. H. Gulliksen* [Math. Scandinav. 34, 167-183 (1974; Zbl 0292.13009)], who proved that $\mathrm{Ext}_B(M,N)$, M, N two finitely generated B-modules, is a finitely generated bigraded module over a polynomial ring S of cohomology operators in variables of degree 2. The authors present this idea following an approach of *D. Eisenbud* [Trans. Am. Math. Soc. 260, 35-64 (1980; Zbl 0444.13006)]. The authors provide methods how to compute $\mathrm{Ext}_B(M,N)$ simultaneously in all homological degrees. It is shown how to write Macaulay2 programs to implement their construction, and how to use the computer to determine invariants of modules over complete intersections that are difficult to obtain otherwise.

For the entire collection see [Zbl 0973.00017].

Reviewer: Peter Schenzel (Halle)

MSC:

13D07	Homological functors on modules of commutative rings (Tor, Ext, etc.)	Cited in **5** Documents
13-04	Software, source code, etc. for problems pertaining to commutative algebra	
13P99	Computational aspects and applications of commutative rings	

Keywords:

Macaulay2; infinite free resolution; complete intersection

Software:

Macaulay2