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Rate and Syzigies of Modules over Veronese Subrings

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Let K be a field, R be a standard graded K -algebra and M be a finitely generated graded R -module. The rate of M , $\text{rate}_R(M)$, is a measure of the growth of the shifts in the minimal graded free resolution of M .

In this talk, we study the rate of Veronese modules of M . More precisely, it is shown that $\text{rate}_{R^{(c)}}(M) \leq \lceil \max\{\text{rate}_R(M), \text{Rate}(R)\}/c \rceil + \max\{0, \lceil t_0^R(M)/c \rceil\}$, for all $c \geq 1$. This extends a result of Herzog et al. As a consequence of this, if M is generated in degree zero, then $\text{reg}_{R^{(c)}}(M) = 0$, for all $c \geq \max\{\text{rate}_R(M), \text{Rate}(R)\}$.

Also, for powers of the homogeneous maximal ideal \mathfrak{m} of R , it is shown that $\text{rate}_{R^{(c)}}(\mathfrak{m}^s(s)) \leq \lceil \text{Rate}(R)/c \rceil$, for all $c \geq 1$. In particular case, we give a simple proof to a theorem of Backelin.