

Artinian level algebras of low socle degree

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Let k be an algebraic closed field of characteristic zero. Macaulay's inverse system gives a bijection between finitely generated R -submodules of $k[x_1, \dots, x_n]$, and ideals I in R such that R/I is Artinian. This correspondence can be restricted to suitable finitely generated R -modules and ideals I such that R/I is level, i.e. such that all socle elements in R/I have the same order. We use this tool to characterize h -vectors which are admissible for level local algebras $(R/I, \mathfrak{m}, k)$ such that $\mathfrak{m}^4 = 0$, and to prove that level local algebras with maximal h -vector and $\mathfrak{m}^4 = 0$ are in fact graded.