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ON A CONSTRUCTION OF INDECOMPOSABLE MODULES AND APPLICATIONS

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1. Introduction

One of the main purposes of this paper is to introduce a new method to get a family $\{M_n\}_{n=1,2,\ldots}$ of indecomposable modules over a commutative Noetherian local ring R with the maximal ideal $\mathfrak{m}$, which will be done in Theorem (2.1) when R possesses a finitely generated R-module C of $\operatorname{depth}_R C \geqq 1$ such that $C \otimes_R \hat{R}$ (R is the completion of R with respect to the $\mathfrak{m}$-adic topology.) is indecomposable and the initial part of a minimal free resolution of C satisfies certain condition. Each M_n is a finitely generated R-module of $\dim_R M_n = \dim_R C$ and $\operatorname{depth}_R M_n = 0$ and if C is Cohen-Macaulay, then M_n is Buchsbaum (see [9] for the definition of Buchsbaum module.). Furthermore $M_n / H_{\mathfrak{m}}^0(M_n)$ ($H_{\mathfrak{m}}^0(M_n) = \bigcup_{i \geq 1} [(0) : \mathfrak{m}^i]_M$) is isomorphic to the direct sum of n-copies of C. Hence in this case there are "big" indecomposable R-modules without limit.

Another aim of us is to apply Theorem (2.1) to the Buchsbaum-representation theory in the one dimensional case. We say that a Noetherian local ring R has finite Buchsbaum-representation type if there are only finitely many isomorphism classes of indecomposable Buchsbaum R-modules M which are maximal, i.e. $\dim_R M = \dim R$. In [4] S. Goto determined the structure of one-dimensional complete Noetherian local rings R of finite Buchsbaum-representation type under the hypothesis that the residue class field of R is infinite, which will be removed in section 3 of this paper. Our family constructed by Theorem (2.1) has the suffix set of non-negative integers and this enables us to develope the same arguments in [4], not assuming the infiniteness of the residue class field.

Throught this paper R is a Noetherian local ring with the maximal ideal $\mathfrak{m}$. We denote by $\hat{R}$ the completion of R with respect to the $\mathfrak{m}$-adic topology and $H_{\mathfrak{m}}^i(\cdot)$ is the i-th local cohomology functor of R relative to $\mathfrak{m}$. For each finitely generated R-module M let $\mu_R(M)$ be the number of elements in a minimal system of generaters for M and let M^n denote the direct sum of n-copies of

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