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Le Thanh Nhan, Luu Phuong Thao, Tran Nguyen An

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LOCAL COHOMOLOGY MODULES VIA CERTAIN FLAT EXTENSION RINGS

LE THANH NHAN

College of Science, Thai Nguyen University
Thai Nguyen, Vietnam
e-mail: nhanlt2014@gmail.com

LUU PHUONG THAO

College of Education, Thai Nguyen University
Thai Nguyen, Vietnam
e-mail: thaoktsp@gmail.com

TRAN NGUYEN AN

College of Education, Thai Nguyen University
Thai Nguyen, Vietnam
e-mail: antrannguyen@gmail.com

Abstract¹. Let (R, \mathfrak{m}) be a Noetherian local ring and M a finitely generated R -module. Let $\mathfrak{P} \in \text{Spec}(\widehat{R})$ and $\mathfrak{p} = \mathfrak{P} \cap R$. Then the natural map $R_{\mathfrak{p}} \rightarrow \widehat{R}_{\mathfrak{P}}$ is a flat local homomorphism. In this paper, we provide some relations between the two sets of attached primes of the Artinian local cohomology modules $H_{\mathfrak{P}\widehat{R}_{\mathfrak{P}}}^{i+r_{\mathfrak{P}}}(M_{\mathfrak{p}} \otimes_{R_{\mathfrak{p}}} \widehat{R}_{\mathfrak{P}})$ and $H_{\mathfrak{p}R_{\mathfrak{p}}}^i(M_{\mathfrak{p}})$, where $i \geq 0$ is an integer and $r_{\mathfrak{P}} = \dim(\widehat{R}_{\mathfrak{P}}/\mathfrak{p}\widehat{R}_{\mathfrak{P}})$. Then, we compute the dimension and multiplicity of $H_{\mathfrak{P}\widehat{R}_{\mathfrak{P}}}^{i+r_{\mathfrak{P}}}(M_{\mathfrak{p}} \otimes_{R_{\mathfrak{p}}} \widehat{R}_{\mathfrak{P}})$ in terms of that of $H_{\mathfrak{p}R_{\mathfrak{p}}}^i(M_{\mathfrak{p}})$ respectively. As applications, we give connections between the Cohen-Macaulayness in dimension $> s$ of $\widehat{M}_{\mathfrak{P}}$ and that of $M_{\mathfrak{p}}$, for an integer $s \geq -1$.

1 Introduction

Let $\varphi : (S, \mathfrak{n}) \rightarrow (S', \mathfrak{n}')$ be a flat local homomorphism of Noetherian local rings. For each finitely generated S -module L , we have the following relations between the set of associated primes of S' -module $L \otimes_S S'$ and that of S -module L (see [Mat, Theorem 23.2])

$$\text{Ass}_{S'}(L \otimes_S S') = \bigcup_{\mathfrak{s} \in \text{Ass}_S L} \text{Ass}(S'/\mathfrak{s}S');$$

$$\text{Ass}_S L = \{\varphi^{-1}(\mathfrak{S}) \mid \mathfrak{S} \in \text{Ass}_{S'}(L \otimes_S S')\}.$$

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