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Homology of artinian and Matlis reflexive modules.

Let R be a commutative noetherian ring, and let M and N be R -modules. We investigate the properties of the functors $\mathrm{Tor}_i^R(M, -)$ and $\mathrm{Ext}_R^i(M, -)$. For instance, we show the following:

1. if M is artinian and N is noetherian, then $\mathrm{Hom}_R(M, N)$ has finite length;
2. if M and N are artinian, then $M \otimes_R N$ has finite length;
3. if M and N are artinian, then $\mathrm{Tor}_i^R(L, L')$ is artinian and $\mathrm{Ext}_R^i(L, L')$ is noetherian over a semilocal ring; and
4. if M is artinian and N is Matlis reflexive, then $\mathrm{Ext}_R^i(M, N)$, $\mathrm{Ext}_R^i(M, N)$, and $\mathrm{Tor}_i^R(M, N)$ are Matlis reflexive.

Also, we study the vanishing behavior of these functors. (Received December 21, 2010)