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**C-Y. Jean Chan\*** (cchan@uark.edu), Department of Mathematics, SCEN 301, University of Arkansas, Fayetteville, AR 72701, and **Jung-Chen Liu** (jccliu@math.ntnu.edu.tw) and **Bernd Ulrich** (ulrich@math.purdue.edu). *Buchsbaum-Rim multiplicity in terms of Hilbert-Samuel multiplicities.*

Let  $R$  be a regular local ring of dimension 2 with maximal ideal  $\mathfrak{m}$ . We study the Buchsbaum-Rim multiplicity  $e_{BR}(M)$  of a finitely generated module  $M$  of finite colength in a free module  $F$ . The main goal of this work is to relate the Buchsbaum-Rim multiplicity of  $M$  to the Hilbert-Samuel multiplicities of ideals naturally arising from  $M$ .

We first investigate the connection between the colength  $\ell(R/\mathfrak{a})$  of an  $\mathfrak{m}$ -primary ideal  $\mathfrak{a}$  and its Hilbert-Samuel multiplicity  $e(\mathfrak{a})$  using linkage theory. As applications, we establish a multiplicity formula that express  $e_{BR}(M)$  in terms of the Hilbert multiplicities of ideals related to a general minimal reduction  $U$  of  $M$ . In the special case where the maximal Fitting ideal of  $F/U$  is integrally closed,  $e_{BR}(M)$  is presented by all Fitting ideals of  $F/U$ .

There exists  $\mathfrak{m}$ -primary Bourbaki ideals  $I$  and  $J$  of the modules  $F$  and  $M$  respectively such that  $F/M \cong I/J$ . We also have a formula for  $e_{BR}(M)$  whenever such  $I$  and  $J$  are given. This is related to a graphical interpretation of the multiplicities in the case of monomial ideals. (Received March 07, 2006)