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Linear syzygies and hyperbolic Coxeter groups

We show that the virtual cohomological dimension of a Coxeter group is essentially the same as the Castelnuovo-Mumford regularity of the Stanley-Reisner ring of its nerve. Using this connection, we modify a construction of Osajda in group theory to find for every positive integer r a quadratic monomial ideal, with linear syzygies, and regularity of the quotient equal to r . This answers a question of Dao, Huneke and Schweig, and shows that Gromov asked essentially the same question about the virtual cohomological dimension of hyperbolic Coxeter groups. For monomial quadratic Gorenstein ideals with linear syzygies we prove that the regularity of their quotients can not exceed four, which implies that for $d > 4$ every triangulation of a d -manifold has an induced square or a hollow simplex. All results are in collaboration with Thomas Kahle and Matteo Varbaro.