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The first L^2-Betti number and approximation in arbitrary characteristic

Mikhail Ershov, Wolfgang Lueck

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Let G be a finitely generated group and (G_i) a descending chain of finite index normal subgroups of G. Given a field K, we consider the sequence b_1 (G_i;K)/[G:G_i] of normalized first Betti numbers of G_i with coefficients in K, which we call a K-approximation for b_1^(2)(G), the first L^2-Betti number of G. In this paper we address the questions of when Q-approximation and F_p-approximation have a limit, when these limits coincide, when they are independent of the sequence (G_i) and how they are related to b_1^(2)(G). In particular, we show that the limit of the sequence b_1(G_i;F_p)/[G:G_i] is greater than or equal to b_1^(2)(G) under the assumptions that (G_i) has trivial intersection and each G/G_i is a finite p-group.

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