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Fox subgroups in modular group algebras

Let G be a finite p-group, S a subgroup of G, and F the prime field of characteristic p. We denote the augmentation ideal of the group algebra FG by $\omega(G)$. The Zassenhaus–Jennings–Lazard series of G is defined by $D_n(G) = G \cap \big(1 + \omega^n(G)\big)$. We first recall a theorem of Quillen stating that the graded algebra associated to FG is isomorphic as an algebra to the enveloping algebra of the restricted Lie algebra associated to the $D_n(G)$. We then extend a theorem of Jennings that provides a basis for the quotient $\omega^n(G)/\omega^{n+1}(G)$ in terms of a basis of the restricted Lie algebra associated to the $D_n(G)$. We shall characterize the subgroups $G \cap \big(1 + \omega(G)\omega^n(S)\big)$ and $G \cap \big(1 + \omega^2(G)\omega^n(S)\big)$, for every positive integer n. These are the modular analogues of Fox subgroups in integral group rings of free groups.