Mathematics > Number Theory

Exponential power series, Galois module structure and differential modules

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We use new over-convergent p-adic exponential power series, inspired by work of Pulita, to build self-dual normal basis generators for the square root of the inverse different of certain abelian weakly ramified extensions of an unramified extension K of Qp. These extensions, whose set we denote by M, are the degree p subextensions over K of Mp,2, the maximal abelian totally, wildly and weakly ramified extension of K, whose norm group contains p. Our construction follows Pickett's, who dealt with the same set M of extensions of K, but does not depend on the choice of a basis of the residue field k of K. Instead it furnishes a one-to-one correspondence, commuting with the action of the Galois group of K/Qp, from the projective space of k onto M. We describe very precisely the norm group of the extensions in M. When K is not equal to Qp, their compositum Mp,2 yields an interesting example of non abelian weakly ramified extension of Qp, with Galois group isomorphic to a wreath product. Finally we show that, with a slight modification, our over-convergent exponential power series endow certain differential modules with a Frobenius structure, generalising a result of Pulita. Unfortunately, they then lose the property we need to build self-dual normal basis generators, hence the desirable link between Galois module structure and differential modules is not yet obtained.

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