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Ramification Theory II: Refined Swan Conductor and Defect

Classical ramification theory deals with extensions of complete discrete valuation rings with perfect residue fields. We would like to study arbitrary valuation rings with possibly *imperfect* residue fields and possibly *non-discrete* valuations of rank ≥ 1 , since several fascinating complications arise for such rings. In particular, defect may occur (i.e. we can have a non-trivial extension, such that there is no extension of the residue field or the value group) when the residue characteristic is positive.

In "Ramification Theory I", we presented a generalization of *Kato's Swan conductor* for degree p extensions of arbitrary valuation fields in residue characteristic $p > 0$. Now we discuss a generalization and further refinement of the *refined Swan conductor* in this case. Our hope is that these results will have many interesting applications in algebraic geometry and number theory.