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## **Calculus and Hodge Theory in characteristic $p$**

### ABSTRACT

Calculus, in particular the differentiation and integration of integral forms and differential equations, makes perfect sense for polynomial and algebraic functions, even when regarded "modulo  $p$ ". Hodge theory, on the other hand, uses harmonic analysis and is profoundly analytic. Nevertheless, it is possible to exploit purely characteristic  $p$  phenomena, which one might at first regard as bizarre pathologies, to construct analogs of Hodge theory in characteristic  $p$ . In some cases these analogies are strong enough to imply classical analytic results. I will attempt to explain recent joint work with V. Vologodsky on "nonabelian Hodge theory" in characteristic  $p$  and its relationship to a recent theorem of Barranikov and Kontsevich concerning differential equations with irregular singular points.