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THE BEHAVIOR OF DIFFERENTIAL FORMS UNDER PURELY INSEPARABLE EXTENSIONS

ROBERTO ARAVIRE, AHMED LAGHRIBI, AND MANUEL O'RYAN

ABSTRACT. Let F be a field of characteristic 2. In this paper we give a complete computation of the kernel of the homomorphism $H_2^{m+1}(F) \rightarrow H_2^{m+1}(L)$ induced by scalar extension, where L/F is a purely inseparable extension (of any degree), $H_2^{m+1}(F)$ is the cokernel of the Artin-Schreier operator $\wp : \Omega_F^m \rightarrow \Omega_F^m/d\Omega_F^{m-1}$ given by: $x \frac{dx_1}{x_1} \wedge \cdots \wedge \frac{dx_m}{x_m} \mapsto (x^2 - x) \frac{dx_1}{x_1} \wedge \cdots \wedge \frac{dx_m}{x_m} + d\Omega_F^{m-1}$, where Ω_F^m is the space of absolute m -differential forms over F and d is the differential operator. Other related results are included.

1. INTRODUCTION

Let F be a field of characteristic 2. For any integer $m \geq 1$, let $\Omega_F^m = \wedge^m \Omega_F^1$ denote the space of absolute m -differential forms ($\Omega_F^0 = F$), where Ω_F^1 is the F -vector space generated by the symbols dx , $x \in F$, subject to the relations: $d(x+y) = dx + dy$ and $d(xy) = xdy + ydx$ for $x, y \in F$. In particular, there is an F^2 -linear map $F \rightarrow \Omega_F^1$, given by: $x \mapsto dx$. This map extends to the differential operator $d : \Omega_F^m \rightarrow \Omega_F^{m+1}$ given by: $d(xdx_1 \wedge \cdots \wedge dx_m) = dx \wedge dx_1 \wedge \cdots \wedge dx_m$. The Artin-Schreier operator $\wp : \Omega_F^m \rightarrow \Omega_F^m/d\Omega_F^{m-1}$ is defined by: $x \frac{dx_1}{x_1} \wedge \cdots \wedge \frac{dx_m}{x_m} \mapsto (x^2 - x) \frac{dx_1}{x_1} \wedge \cdots \wedge \frac{dx_m}{x_m} + d\Omega_F^{m-1}$, and the cokernel of this operator is denoted by $H_2^{m+1}(F)$.

For any field extension L/F , we have a group homomorphism $H_2^{m+1}(F) \rightarrow H_2^{m+1}(L)$ induced by the inclusion $F \subset L$. An important problem consists in computing the kernel $H_2^{m+1}(L/F)$ of this homomorphism. The motivation of considering this problem is the computation of the (graded-)Witt kernel for the extension L/F which reduces to the computation of $H_2^{m+1}(L/F)$ by a celebrated result of Kato [11]. Up to now, the kernel $H_2^{m+1}(L/F)$ is known in the following cases:

- (a) L is the function field of a projective F -quadric given by a bilinear Pfister form of arbitrary dimension, or a quadratic Pfister form of dimension 2^k such that $m \leq k$ [3], [7, See after Question 8.1].
- (b) L is a quadratic extension of F [2], [3].

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