1077-11-939 **Mark Giesbrecht*** (mwg@uwaterloo.ca), Cheriton School of Computer Science, University of Waterloo, Waterloo, ON N2L 3G1, and **Joachim von zur Gathen** (gathen@bit.uni-bonn.de), B-IT, University of Bonn, D-53113, Bonn, Germany. *Counting decompositions of additive polynomials.*

We consider the problem of counting decompositions of r-additive (or linearized) polynomials over a finite field $\mathbb{F}_q$, for q a power of a prime power r. The r-additive polynomials in $\mathbb{F}_q[x]$ have the form $f = \sum_{0 \le i \le d} f_i x^{r^i}$. We count the number of distinct functional decompositions of r-additive polynomials with a right component of degree r:

$$C(f) = \#\left\{a \in \mathbb{F}_q : \ f = g \circ (x^r + ax)\right\},$$
$$R(d) = \left\{C(f) : f \in \mathbb{F}_q[x] \text{ monic, squarefree, } r\text{-additive of degree } r^d\right\}.$$

We determine $R(d)$ for all d, and in particular $R(2) = \{0, 1, 2, r+1\}$ and $R(3) = \{0, 1, 2, 3, r+1, r+2, r^2+r+1\}$. For $R(2)$ this is consistent with the work of Bluher (2004), who also considers the inverse problem of finding formulas for the number of polynomials in each class. I.e., for given d find

$$A_i^{(d)} = \#\left\{f \in \mathbb{F}_q[x] \text{ monic, squarefree, } r\text{-additive of degree } r^d, \ C(f) = i\right\}.$$

Bluher gives formulas for $d = 2$. We demonstrate analogous formulae for $d = 3$, and discuss the problem for more general d. We also provide computable constructions and fast algorithms, requiring time polynomial in d and $\log q$. (Received September 14, 2011)