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The left and right dimensions of a skew field over the subfield of invariants

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ABSTRACT

If H is a Hopf algebra and A an H-module algebra without nontrivial H-stable left or right ideals, then the subalgebra of H-invariant elements A^H is a skew field and A may be regarded as a vector space over A^H with respect to either left or right multiplications. It is proved in the paper that the left dimension of A over A^H is equal to the right dimension under the assumptions that A is semiprimary and $\dim H < \infty$. In the case when A is itself a skew field, this answers a question raised by J. Bergen, M. Cohen and D. Fischman.

Introduction

Let A be a left H-module algebra where H is a finite dimensional Hopf algebra over a field k. In the case when A is a skew field, i.e., a division ring, the subring of H-invariant elements A^H is a skew field too, and both the left dimension $[A : A^H]_l$ and the right dimension $[A : A^H]_r$ of A over A^H are finite. In a 1990 paper Bergen, Cohen

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