COHOMOLOGY RINGS AND APPLICATION IN HYPERNORMAL FORM FOR A CLASS OF 4-DIMENSIONAL VECTOR FIELDS

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Homological algebra was established in the 1940s, which is a powerful tool for solving the problem in ring theory [1]. With respect to good properties, homological algebra is attracting widespread interest in fields such as group theory[2], algebraic topology and differential equations [3], etc. One of the major challenges in ordinary differential equations is further reduction of vector fields, in which the theory of normal form plays an important role [4].An interesting insight concerning the application of cohomology rings in differential equations is presented.

In this paper, the application of cohomology rings theory in the research of hypernormal form (unique normal form, simplest normal form) and the associated coefficients for a class of four-dimensional vector fields is investigated. Based on the theory of cohomology rings, hypernormal form for four-dimensional vector fields is obtained by using the method of the combination of Hilbert series, new grading function and multiple Lie brackets. With aid of the method of combining multiple Lie brackets with parametric transformation, the corresponding relations of coefficients between original vector fields and its further reduction are given.

The research project is supported by National Natural Science Foundation of China (11772007, 11372014, 11802200) and also supported by Beijing Natural Science Foundation (1172002, Z180005).

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2010 *Mathematics Subject Classification.* 70K45, 30G05, 15B33.