

Ohara, Katsuyoshi; Tajima, Shinichi

An algorithm for computing Grothendieck local residues. I: Shape basis case. (English)

Zbl 07095839

Math. Comput. Sci. 13, No. 1-2, 205-216 (2019)

Summary: Grothendieck local residue is considered in the context of symbolic computation. Basic ideas of our approach are the use of local cohomology, holonomic D -modules, and Noether operators. An effective method is introduced for computing Grothendieck local residues of rational n -forms under shape basis condition. Resulting algorithms that avoid the use of Gröbner bases on the Weyl algebra and an implementation are described. Some examples are also given for illustration.

MSC:

32A27 Residues for several complex variables

13N10 Commutative rings of differential operators and their modules

Cited in **1** Review
Cited in **1** Document

Keywords:

local residues; local cohomology; holonomic system; computer algebra

Software:

Risa/Asir; OpenXM

Full Text: DOI

References:

- [1] Altman, A., Kleiman, S.: Introduction to Grothendieck Duality Theory. Lecture Notes in Mathematics, vol. 146. Springer, Berlin (1970) · Zbl 0215.37201 · doi:10.1007/BFb0060932
- [2] Ehrenpreis, L.: Fourier Analysis in Several Complex Variables. Wiley, New York (1970) · Zbl 0195.10401
- [3] Gianni, P., Mora, T.: Algebraic solution of systems of polynomial equation using Gröbner bases. In: Proceedings of the AAEECC 5, LNCS vol. 356, pp. 247-257 (1989)
- [4] Gianni, P.; Trager, B.; Zacharias, G., Gröbner bases and primary decomposition of polynomial ideals, J. Symb. Comput., 6, 149-167, (1988) · Zbl 0667.13008 · doi:10.1016/S0747-7171(88)80040-3
- [5] Griffiths, P., Harris, J.: Principles of Algebraic Geometry. Wiley, New York (1978) · Zbl 0408.14001
- [6] Hartshorne, R.: Residues and Duality. Lecture Notes in Mathematics, vol. 20. Springer, Berlin (1966) · Zbl 0212.26101 · doi:10.1007/BFb0080482
- [7] Kashiwara, M., On the maximally overdetermined system of linear differential equations. I, Res. Inst. Math. Sci., 10, 563-579, (1975) · Zbl 0313.58019 · doi:10.2977/prims/1195192011
- [8] Kashiwara, M., On the holonomic systems of linear differential equations. II, Invent. Math., 49, 121-135, (1978) · Zbl 0401.32005 · doi:10.1007/BF01403082
- [9] Kashiwara, M., On holonomic systems of micro-differential equations. III: systems with regular singularities, Res. Inst. Math. Sci., 17, 813-979, (1981) · Zbl 0505.58033 · doi:10.2977/prims/1195184396
- [10] Nakamura, Y.; Tajima, S., Residue calculus with differential operator, Kyushu J. Math., 54, 127-138, (2000) · Zbl 0993.32008 · doi:10.2206/kyushujm.54.127
- [11] Noro, M.: New algorithms for computing primary decomposition of polynomial ideals. In: Mathematical Software—ICMS 2010. Lecture Notes in Computer Science, vol. 6327, pp. 233-244. Springer, Berlin (2010) · Zbl 1229.13003
- [12] Noro, M., et al.: Risa/Asir a computer algebra system, 1994-2018. <http://www.math.kobe-u.ac.jp/Asir/> · Zbl 1027.68152
- [13] Oaku, T., Algorithms for the \mathbb{b} -functions, restrictions, and algebraic local cohomology groups of \mathbb{D} -modules, Adv. Appl. Math., 19, 61-105, (1997) · Zbl 0938.32005 · doi:10.1006/aama.1997.0527
- [14] Oaku, T.; Takayama, N., Algorithms for \mathbb{D} -modules—restriction, tensor product, localization, and local cohomology groups, J. Pure Appl. Algebra, 156, 267-308, (2001) · Zbl 0983.13008 · doi:10.1016/S0022-4049(00)00004-9
- [15] OpenXM committers: OpenXM, a project to integrate mathematical software systems. 1998-2018. <http://www.openxm.org>
- [16] Pham, F.: Singularités des Systèmes Différentielles de Gauss-Manin. Birkhäuser, Basel (1979)
- [17] Palamodev, V.P.: Linear Differential Operators with Constant Coefficients. Springer, New York (1970) · doi:10.1007/978-3-

- [18] Tajima, S.: On Noether differential operators attached to a zero-dimensional primary ideal—a shape basis case. In: Finite or Infinite Dimensional Complex Analysis and Applications, pp. 357-366. Kyushu University Press, Fukuoka (2005) · [Zbl 1140.32302](#)
- [19] Tajima, S.: Noether differential operators and Grothendieck local residues. RIMS Kôkyûroku **1432**, 123-136 (2005)
 \textbf{(in Japanese)}
- [20] Tajima, S.; Oaku, T.; Nakamura, Y., Multidimensional local residues and holonomic (D) -modules, RIMS Kôkyûroku, 1033, 59-70, (1998) · [Zbl 0944.32008](#)
- [21] Tajima, S.; Nakamura, Y., Computational aspects of Grothendieck local residues, Séminaires et Congrès, 10, 287-305, (2005) · [Zbl 1089.32002](#)

This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.