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Foreword to the article: Computing representations for radicals of finitely generated differential ideals

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The first stage of this article was written in 1997. The present version is essentially the same as the one embedded in [15]

The modifications made are the following:

1. modification of the appearance of the paper (AAECC presentation instead of JSC, removal of blank lines to save pages);
2. minor edition of many sentences, with no modification of their meaning;
3. most references to [18] were replaced by references to [19]; some new references were added; a wrong reference was fixed; the bibliography was updated (papers which were not yet published in 1997 are now published);
4. the term "pair" was replaced by "critical pair" everywhere;
5. a new comment was inserted in a footnote in Sect. 4.3;
6. an incorrect paragraph commenting [8, Theorem 4.11] was removed at the end of Sect. 7;
7. a figure presenting the pseudocode of *Rosenfeld–Gröbner* was inserted in Sect. 5 (this pseudocode did not appear in the original paper);
8. the description of the completion process, as well as some implementation details are now presented in a figure in Sect. 5.

The introduction of the paper is ten years old. To update it, one should cite at least [10, 12, 17] for elimination methods and [7] among introductory texts to differential algebra.

About Lazard's Lemma, [17] established the relationship with Kolchin's work and [6] unifies the equidimensionality argument for the ideals saturated by the separants and for the ideals saturated by the initials.

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The *characteristic presentations* introduced in this paper are particular cases of characteristic sets and would probably be called “strongly normalized regular differential chains” today. Observe that they are now available as well in the MAPLE `diffalg` package as in the BLAD libraries [3] by means of the method described in [5], which is actually a mere application of the comment preceding Sect. 6.1.1. These methods just express the fact that the computation of the characteristic presentations from the regular differential systems is a purely algebraic problem, as proved for the first time by [9]. Related references to [1,13] should also be mentioned.

On the computation of formal power series solutions, one should also refer to [2,4,11,14,16].

References

1. Aubry, P., Lazard, D., Maza, M.M.: On the theories of triangular sets. J. Symb. Comput. **28**, 105–124 (1999)
2. Bostan, A., Chyzak, F., Ollivier, F., Salvy, B., Schost, É., Sedoglavic, A.: Fast computation of power series solutions of systems of differential equations. In: SODA’07, ACM-SIAM Symposium on Discrete Algorithms, pp. 1012–1021 (2007)
3. Boulier, F.: The BLAD libraries (2004). http://www.lifl.fr/~boulier/BLAD
4. Boulier, F., Lemaire, F.: A computer scientist point of view on Hilbert’s differential theorem of zeros. Appl. Algebra Eng. Commun. Comput. (submitted) (2007). http://hal.archives-ouvertes.fr/hal-00170091
5. Boulier, F., Lemaire, F.: Computing canonical representatives of regular differential ideals. In: ISSAC’00: Proceedings of the 2000 International Symposium on Symbolic and Algebraic Computation, pp. 38–47. ACM Press, New York (2000). http://hal.archives-ouvertes.fr/hal-00139177
6. Boulier, F., Lemaire, F., Maza, M.M.: Well known theorems on triangular systems and the D^5 principle. In: Proceedings of Transgressive Computing, pp. 79–91, Granada, Spain, 2006. http://hal.archives-ouvertes.fr/hal-00137158
7. Buium, A., Cassidy, P.: Differential Algebraic Geometry and Differential Algebraic Groups: From Algebraic Differential Equations to Diophantine Geometry, pp. 567–636. American Mathematical Society, Providence (1998)
8. Denef, J., Lipshitz, L.: Power series solutions of algebraic differential equations. Mathematische Annalen. **267**, 213–238 (1984)
9. Hubert, É.: Factorization free decomposition algorithms in differential algebra. J. Symb. Comput. **29**:4–5, 641–662 (2000)
10. Hubert, É.: Notes on triangular sets and triangulation-decomposition algorithm II: Differential Systems. Symbolic and Numerical Scientific Computing 2001, pp. 40–87 (2003)
11. Hubert, É., Roux, N.L.: Computing power series solutions of a nonlinear PDE system. In: Proceedings of ISSAC 2003, pp. 148–155 (2003)
12. Li, Z., Wang, D.: Coherent, regular and simple systems in zero decompositions of partial differential systems. Syst. Sci. Math. Sci. **12**, 43–60 (1999)
13. Maza, M.M., Rioboo, R.: Polynomial gcd computations over towers of algebraic extensions. In: Proceedings of AAECC11, pp. 365–382. Springer, Heidelberg (1995)
14. Péladan-Germa, A.: Testing Equality in Differential Ring Extensions Defined by PDE’s and Limit Conditions, AAECC, vol. 13, 4, pp. 257–288 (2002)
15. Petitot, M.: Quelques méthodes de Calcul Formel appliquées à l’étude des équations différentielles, Mémoire d’habilitation à diriger des recherches, Université Lille I, LIFL, 59655 Villeneuve d’Ascq, France, February 1999
16. Rust, C.J., Reid, G.J., Wittkopf, A.D.: Existence and uniqueness theorems for formal power series solutions of analytic differential systems. In: Proceedings of ISSAC 1999, Vancouver, Canada (1999)
17. Sadik, B.: Une note sur les algorithmes de décomposition en algèbre différentielle. C. R. Acad. Sci., Paris **330**, 641–646 (2000)
18. van der Waerden, B.L.: Algebra. 7th edn. Springer, Berlin (1966)
19. Zariski, O., Samuel, P.: Graduate Texts in Mathematics, vols. 28 and 29, Springer, Heidelberg