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On isomorphism criteria for Leibniz central extensions of a linear deformation of μ_n. (English summary)

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The paper deals with classification problems of Leibniz central extensions of linear deformations of a Lie algebra.

For a Leibniz algebra L over $\mathbb{C}$, let $L^1 = L$ and $L^{k+1} = [L^k, L]$. L is said to be filiform if $\dim L^i = n - i$, where $n = \dim L$ and $2 \le i \le n$. The set of n-dimensional filiform Leibniz algebras is denoted by Leib_n. Let $L \in \mathrm{Leib}_{n+1}$; then it admits an adapted basis $\{e_0, e_1, \ldots, e_n\}$ such that its multiplication table is of type FLeib_{n+1}, SLeib_{n+1} or TLeib_{n+1}, using the notation from [J. R. Gómez and B. A. Omirov, "On classification of complex filiform Leibniz algebras", preprint, arXiv:math/0612735]. The first two types in low dimensions are the subject of several papers [I. S. Rakhimov and U. D. Bekbaev, Comm. Algebra **38** (2010), no. 12, 4705–4738; MR2805139; I. S. Rakhimov and S. K. Said Husain, Linear Multilinear Algebra **59** (2011), no. 2, 205–220; MR2773651; Linear Multilinear Algebra **59** (2011), no. 3, 339–354; MR2774088]. To discuss the type TLeib_{n+1} it is necessary to consider first particular cases in order to proceed to the general case. Along this line, the authors consider a subtype of TLeib_{n+1} denoted by $\mathrm{Ced}(\mu_n)$, corresponding to Leibniz algebras consisting of linear transformations of μ_n, the n-dimensional filiform Lie algebras given by the brackets $[e_i, e_0] = e_{i+1}$, $i = 0, \ldots, n-1$ in a basis $\{e_0, \ldots, e_{n-1}\}$, and their Leibniz central extensions.

The main results contain the conditions required for an $(n+1)$-dimensional filiform Leibniz algebra with an adapted basis of type $\mathrm{Ced}(\mu_n,)$ and isomorphism criteria for such algebras for $n \ge 6$. The isomorphism criteria for specific five- and six-dimensional cases, i.e. $\mathrm{Ced}(\mu_4)$ and $\mathrm{Ced}(\mu_5)$, are provided. The final section contains a computer program that generates multiplication tables for adapted bases.

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References

1. S. Albeverio, Sh. A. Ayupov and B. A. Omirov, On Cartan subalgebras, weight spaces and criterion of solvability of finite dimensional Leibniz algebras, *Rev. Math. Complut.* **19**(1) (2006) 183–195. MR2219828
2. C. Cuvier, Homologie de Leibniz et homologie de Hochschild, *C. R. Acad. Sci. Paris Ser. I Math.* **313** (1991) 569–572. MR1133486
3. A. Dzhumadil'daev and S. Abdykassymova, Leibniz algebras in characteristic p, *C. R. Acad. Sci. Paris. Ser. I Math.* **332** (2001) 1047–1052. MR1847478
4. A. Fialowski, A. Mandal and G. Mukherjee, Versal deformations of Leibniz algebras, *J. of K-Theory,* doi:10.1017/is008004027jkt049 (2008). MR2496451
5. J. R. Gómez and B. A. Omirov, On classification of complex filiform Leibniz algebras, available at: http://front.math.ucdavis.edu/, arXiv: math/0612735v1 [math.RA], (2006). MR3420708
6. M. K. Kinyon and A. Weinstein, Leibniz algebras, Courant algebroids, and multiplications on reductive homogeneous spaces, *Amer. J. Math.* **123**(3) (2001) 525–550.

MR1833152
7. J.-L. Loday, Une version non commutative des algèbres de Lie: Les algèbres de Leibniz, *L'Ens. Math.* **39** (1993) 269–293. MR1252069
8. J.-L. Loday, A. Frabetti, F. Chapoton and F. Goichot, Dialgebras and Related Operads, Lecture Notes in Mathematics, Vol. IV (2001), 1763. MR1864390
9. J.-L. Loday and T. Pirashvili, Universal enveloping algebras of Leibniz algebras and (co)homology, *Math. Ann.* **296** (1993) 139–158. MR1213376
10. D. Liu and N. Hu, Leibniz central extensions on some infinite-dimensional Lie algebras, *Commun. Algebra.* **32**(6) (2004) 2385–2405. MR2100478
11. B. A. Omirov, Conjugacy of Cartan subalgebras of complex finite-dimensional Leibniz algebras, *J. Algebra* **302** (2006) 887–896. MR2293789
12. B. A. Omirov and I. S. Rakhimov, On Lie-like complex filiform Leibniz algebras, *Bull. Austral. Math. Soc.* **79** (2009) 391–404. MR2505345
13. I. S. Rakhimov and M. A. Hassan, On one dimensional Leibniz central extensions of a naturally graded filiform Lie algebra. Bulletin of the Australian Mathematical Society (to appear). MR2832616
14. I. S. Rakhimov, U. D. Bekbaev, On isomorphism classes and invariants of Finite Dimensional Complex Filiform Leibniz Algebras, *Communications in Algebra,* **38**(12) (2010) 4705–4738. MR2805139
15. I. S. Rakhimov and S. K. Said Husain, On isomorphism classes and invariants of lowdimensional complex filiform Leibniz algebras, *Linear and Multiplinear Algebra,* **59**(2) (2011) 205–220. MR2773651
16. I. S. Rakhimov and S. K. Said Husain, Classification of a subclass of nilpotent Leibriz algebras, *Linear and Multiplinear Algebra,* **59**(3) (2011) 339–354. MR2774088
17. Y. Hagivara and T. Mizutani, Leibniz algebras associated with foliations, *Kodai Math. J.* **25**(2) (2002) 151–165. MR1913522
18. J. M. Lodder, Leibniz cohomology for differentiable manifolds, *Ann. Inst. Fourier* (Grenoble) **48**(1) (1998) 73–95. MR1614906

Note: This list reflects references listed in the original paper as accurately as possible with no attempt to correct errors.