

**REPRESENTATIONS OF WEIGHTED ROTA-BAXTER
JACOBI-JORDAN ALGEBRAS**

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ABSTRACT. Weighted Rota-Baxter Jacobi-Jordan algebras and their representations are studied. Moreover, we consider weighted Rota-Baxter paired operators that are related to weighted Rota-Baxter Jacobi-Jordan algebras together with their representations. Finally, we define suitable cohomology for weighted Rota-Baxter Jacobi-Jordan algebras in low degrees.

REFERENCES

- [1] M. Aguiar: *Pre-Poisson algebras*, Lett. Math. Phys., **54**(2000), 263-277.
- [2] F.V. Atkinson: *Some aspects of Baxter's functional equation*, J. Math. Anal. Appl., **7**(1963), 1-30.
- [3] C. Bai, O. Bellier, L. Guo and X. Ni: *Splitting of operations, Manin products and Rota-Baxter operators*, Int. Math. Res. Not. IMRN, **2013**(2013), 485-524.
- [4] C. Bai, L. Guo and X. Ni: *Nonabelian generalized Lax pairs, the classical Yang-Baxter equation and PostLie algebras*, Comm. Math. Phys., **297**(2010), 553-596.
- [5] C. Bai, L. Guo and X. Ni: *Relative Rota-Baxter algebras and tridendriform algebras*, J. Algebra Appl., **12**(2013), 1350027.
- [6] A. Baklouti and S. Benayadi: *Symplectic Jacobi-Jordan algebras*, Linear Multilinear Algebra, **69**(2021), 1557-1578.
- [7] A. Baklouti, S. Benayadi, A. Makhlof and Sabeur Mansour: *Cohomology and deformations of Jacobi-Jordan algebras*, Bol. Soc. Mat. Mex. (3), **31**(2025), Art. No. 114, 25 pages.
- [8] G. Baxter: *An analytic problem whose solution follows from a simple algebraic identity*, Pacific J. Math., **10**(1960), 731-742.
- [9] D. Burde and A. Fialowski: *Jacobi-Jordan algebras*, Linear Algebra Appl., **459**(2014), 586-594.
- [10] P. Cartier: *On the structure of free Baxter algebras*, Adv. Math., **9**(1972), 253-265.
- [11] A. Connes and D. Kreimer: *Renormalization in quantum field theory and the Riemann-Hilbert problem. I. The Hopf algebra structure of graphs and the main theorem*, Comm. Math. Phys., **210**(2000), 249-273.
- [12] A. Das: *Deformations of associative Rota-Baxter operators*, J. Algebra, **560**(2020), 144-180.
- [13] A. Das: *Cohomology and deformations of weighted Rota-Baxter operators*, 11 Aug 2021, arXiv:2108.05411v1 [math.RT], 19 pages.
- [14] A. Das: *Cohomology of weighted Rota-Baxter Lie algebras and Rota-Baxter paired operators*, 4 September 2021, arXiv:2109.01972v1 [math.RT], 21 pages.
- [15] K. Ebrahimi-Fard: *Loday-type algebras and the Rota-Baxter relation*, Lett. Math. Phys., **61**(2002), 139-147.
- [16] K. Ebrahimi-Fard and L. Guo: *Rota-Baxter algebras and dendriform algebras*, J. Pure Appl. Algebra, **212**(2008), 320-339.
- [17] L. Guo and W. Keigher: *Baxter algebras and shuffle products*, Adv. Math., **150**(2000), 117-149.

Received: November 02, 2025. *Revised:* March 20, 2026.

2020 Mathematics Subject Classification: 17C50, 16W10, 17B56.

Key words and phrases: Jacobi-Jordan algebras, Rota-Baxter operators, representations, Rota-Baxter paired operators, cohomology.

- [18] L. Guo, H. Lang and Y. Sheng: *Integration and geometrization of Rota-Baxter Lie algebras*. Adv. Math., **387**(2021), Paper No. 107834, 34 pages
- [19] L. Guo and B. Zhang: *Renormalization of multiple zeta values*, J. Algebra, **319**(2008), 3770-3809.
- [20] J. Jiang, Y. Sheng and C. Zhu, *Lie theory and cohomology of relative Rota-Baxter operators*, J. Lond. Math. Soc. (2), **109**(2024), No. 2, Paper No. e12863, 34 pages.
- [21] J. Jiang and Y. Sheng: *Representations and cohomologies of relative Rota-Baxter Lie algebras and applications*, J. Algebra, **602**(2022), 637-670.
- [22] B.A. Kupershmidt: *What a classical r-matrix really is*, J. Nonlinear Math. Phys., **6**(1999), No. 4, 448-488.
- [23] N.D. Oro and S. Attan: *Cohomologies and linear deformations of relative Rota-Baxter operators on (pre-)Jacobi-Jordan algebras*, 5 August 2025, arXiv:2508.03096v1 [math.RA], 36 pages.
- [24] G.-C. Rota: *Baxter algebras and combinatorial identities, I, II*, Bull. Amer. Math. Soc., **75**(1969), 325-329; *ibid.* **75**(1969), 330-334.
- [25] K. Wang and G. Zhou: *Deformations and homotopy theory of Rota-Baxter algebras of any weight*, 8 Sep 2021, arXiv:2108.06744v2 [math.RA], 52 pages.
- [26] Y. Zhang, X. Gao and J. Zheng: *Weighted infinitesimal unitary bialgebras on matrix algebras and weighted associated Yang-Baxter equations*, 2 Nov 2018, arXiv:1811.00842v1 [math.RA], 24 pages.
- [27] H. Zheng, L. Guo and L. Zhang: *Rota-Baxter paired modules and their constructions from Hopf algebras*, J. Algebra, **559**(2020), 601-624.
- [28] P. Zumanovich: *Special and exceptional mock-Lie algebras*, Linear Algebra Appl., **518**(2017), 79-96.

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