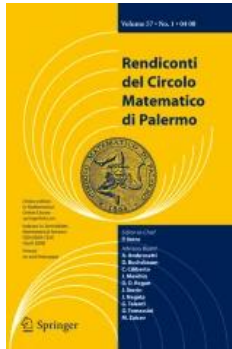


Eigenfunction expansion for impulsive singular Hahn–Dirac system

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Abstract

In this study, a singular impulsive Hahn–Dirac system is studied. A spectral function has been established for this type of system. With the help of this function, the Parseval equation and eigenfunction expansion were obtained.

References

1. Allahverdiev, B.P., Tuna, H.: The spectral expansion for the Hahn–Dirac system on the whole line. *Turk. J. Math.* **43**, 1668–1687 (2019)

[Article](#) [MathSciNet](#) [Google Scholar](#)

2. Allahverdiev, B.P., Tuna, H.: The Parseval equality and expansion formula for singular Hahn–Dirac system. In: Alparslan Gök, S., Aruğaslan Çinçin, D. (eds.) *Emerging Applications of Differential Equations and Game Theory*, pp. 209–235. IGI Global, Hershey (2020). <https://doi.org/10.4018/978-1-7998-0134-4.ch010>
3. Allahverdiev, B.P., Tuna, H.: Spectral analysis of Hahn–Dirac system. *Proyecciones (Antofagasta, On line)* **40**(6), 1547–1567 (2021)

[Article](#) [MathSciNet](#) [Google Scholar](#)

4. Annaby, M.H., Hamza, A.E., Aldwoah, K.A.: Hahn difference operator and associated Jackson–Nörlund integrals. *J. Optim. Theory Appl.* **154**, 133–153 (2012)

[Article](#) [MathSciNet](#) [Google Scholar](#)

- Annaby, M.H., Hamza, A.E., Makhraresh, S.D.: A Sturm–Liouville theory for Hahn difference operator. In: Li, X., Nashed, Z. (eds.) *Frontiers of Orthogonal Polynomials and q -Series*, pp. 35–84. World Scientific, Singapore (2018)

[Chapter](#) [Google Scholar](#)

- Amirov, Kh.R., Ozkan, A.S.: Discontinuous Sturm–Liouville problems with eigenvalue dependent boundary condition. *Math. Phys. Anal. Geom.* **17**(3–4), 483–491 (2014)

[Article](#) [MathSciNet](#) [Google Scholar](#)

- Aydemir, K., Olğar, H., Mukhtarov, O.S.: The principal eigenvalue and the principal eigenfunction of a boundary-value-transmission problem. *Turk. J. Math. Comput. Sci.* **11**(2), 97–100 (2019)

[Google Scholar](#)

- Aydemir, K., Olgar, H., Mukhtarov, O.S., Muhtarov, F.: Differential operator equations with interface conditions in modified direct sum spaces. *Filomat* **32**(3), 921–931 (2018)

[Article](#) [MathSciNet](#) [Google Scholar](#)

- Aygar, Y., Bairamov, E.: Scattering theory of impulsive Sturm–Liouville equation in quantum calculus. *Bull. Malays. Math. Sci. Soc.* **42**, 3247–3259 (2019). <https://doi.org/10.1007/s40840-018-0657-2>

[Article](#) [MathSciNet](#) [Google Scholar](#)

- Bohner, M., Cebesoy, S.: Spectral analysis of an impulsive quantum difference operator. *Math. Methods Appl. Sci.* **42**, 5331–5339 (2019). <https://doi.org/10.1002/mma.5348>

[Article](#) [MathSciNet](#) [Google Scholar](#)

- Guseinov, G.S.: An expansion theorem for a Sturm–Liouville operator on semi-unbounded time scales. *Adv. Dyn. Syst. Appl.* **3**(1), 147–160 (2008)

[MathSciNet](#) [Google Scholar](#)

- Guseinov, G.S.: Eigenfunction expansions for a Sturm–Liouville problem on time scales. *Int. J. Differ. Equ.* **2**(1), 93–104 (2007)

[MathSciNet](#) [Google Scholar](#)

- Hahn, W.: Beiträge zur theorie der Heineschen Reihen. *Math. Nachr.* **2**, 340–379 (1949). ((in German))

[Article](#) [MathSciNet](#) [Google Scholar](#)

14. Hahn, W.: Ein Beitrag zur theorie der orthogonalpolynome. *Monatsh. Math.* **95**, 19–24 (1983)

[Article](#) [MathSciNet](#) [Google Scholar](#)

15. Hira, F.: Dirac system associated with Hahn difference operator. *Bull. Malays. Math. Sci. Soc.* **43**, 3481–3497 (2020)

[Article](#) [MathSciNet](#) [Google Scholar](#)

16. Huseynov, A., Bairamov, E.: On expansions in eigenfunctions for second order dynamic equations on time scales. *Nonlinear Dyn. Syst. Theory* **9**(1), 77–88 (2009)

[MathSciNet](#) [Google Scholar](#)

17. Karahan, D., Mamedov, K.R.: On a q -boundary value problem with discontinuity conditions. *Vestn. Yuzhno-Ural. Gos. Un-ta. Ser. Matem. Mekh. Fiz.* **13**(4), 5–12 (2021)

[Google Scholar](#)

18. Karahan, D., Mamedov, K.R.: On a q -analogue of the Sturm–Liouville operator with discontinuity conditions. *Vestn. Samar. Gos. Tekh. Univ. Ser. Fiz.-Mat. Nauk.* **26**(3), 407–418 (2022)

[Article](#) [Google Scholar](#)

19. Karahan, D., Mamedov, K.R.: Sampling theory associated with q -Sturm–Liouville operator with discontinuity conditions. *J. Contemp. Appl. Math.* **10**(2), 40–48 (2020)

[Google Scholar](#)

20. Koyunbakan, H., Panakhov, E.S.: Solution of a discontinuous inverse nodal problem on a finite interval. *Math. Comput. Model.* **44**(1–2), 204–209 (2006)

[Article](#) [MathSciNet](#) [Google Scholar](#)

21. Levitan, B.M., Sargsjan, I.S.: *Sturm–Liouville and Dirac Operators. Mathematics and Its Applications (Soviet Series)*, Kluwer Academic Publishers Group, Dordrecht (1991). ((translated from the Russian))

[Book](#) [Google Scholar](#)

22. Naimark, M.A.: *Linear Differential Operators*, 2nd edn. Nauka, Moscow (1969). (English transl. of 1st. edn., 1,2, New York (1968))

[Google Scholar](#)

23. Ozkan, A.S., Amirov, R.K.: An interior inverse problem for the impulsive Dirac operator. *Tamkang J. Math.* **42**(3), 259–263 (2011)

[Article](#) [MathSciNet](#) [Google Scholar](#)

24. Titchmarsh, E.C.: Eigenfunction Expansions Associated with Second-Order Differential Equations, Part I, 2nd edn. Clarendon Press, Oxford (1962)

[Google Scholar](#)

25. Wang, Y.P., Koyunbakan, H.: On the Hochstadt–Lieberman theorem for discontinuous boundary-valued problems. *Acta Math. Sin. Engl. Ser.* **30**(6), 985–992 (2014)

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