



UDC 517.937, 517.983

## About Reversibility States of Linear Differential Operators with Periodic Unbounded Operator Coefficients

V. B. Didenko

Voronezh State University, 1, Universitetskaya pl., 394006, Voronezh, Russia, vladimir.didenko@gmail.com

For investigated linear differential operator (equation) with unbounded periodic operator coefficients defined at one of the Banach space of vector functions defined on all real axis difference operator (equation) with constant operator coefficient defined at appropriate Banach space of two-side vector sequences is considered. For differential and difference operators propositions about kernel and co-image dimensions coincidence, simultaneous complementarity of kernels and images, simultaneous reversibility, spectrum interrelation are proved.

*Key words:* differential operators, difference operators, reversibility states, spectrum.

*This work was supported by the Russian Foundation for Basic Research (projects no. 13-01-00378, no. 14-01-31196).*

### References

1. Krein S. G. *Linear Differential Equations in Banach Space*. American Math. Soc., 1971. 390 p.
2. Howland J. S. Stationary scattering theory for time-dependent Hamiltonians. *Math. Ann.*, 1974, vol. 207, no. 4., pp. 315–335.
3. Baskakov A. G. Spectral analysis of linear differential operators and semi-groups of difference operators. *Doklady Mathematics*, 1995, vol. 343, no. 3, pp. 295–298 (in Russian).
4. Baskakov A. G. Semigroups of difference operators in spectral analysis of linear differential operators. *Functional Analysis and Its Applications*, 1996, vol. 30, no. 3, pp. 149–157. DOI: 10.1007/BF02509501.
5. Hille E., Phillips R. S. *Functional Analysis and Semigroups*. American Math. Soc., 1957, 808 p.
6. Henry D. *Geometric Theory of Semilinear Parabolic Equations*. Springer, 1993. 350 p.
7. Baskakov A. G., Pastukhov A. I. Spectral Analysis of a Weighted Shift Operator with Unbounded Operator Coefficients. *Siberian Math. J.*, 2001, vol. 42, no. 6, pp. 1026–1036. DOI: 10.1023/A:1012832208161.
8. Dunford N., Schwartz J. T. *Linear Operators: General theory*. Interscience Publishers, 1958. 2592 p.
9. Didenko V. B. On the spectral properties of differential operators with unbounded operator coefficients determined by a linear relation. *Math. Notes*, 2011, vol. 89, no. 2, pp. 224–237. DOI: 10.1134/S0001434611010287.
10. Didenko V. B. On the continuous invertibility and the Fredholm property of differential operators with multi-valued impulse effects. *Izvestiya : Mathematics*, 2013, vol. 77, no. 1, pp. 3–19. DOI: 10.1070/IM2013v077n01ABEH002626.
11. Baskakov A. G., Kobychiev K. S. Estimates for the embedding operator of a sobolev space of periodic functions and for the solutions of differential equations with periodic coefficients. *Differential Equations*, 2011, vol. 47, no. 5, pp. 609–619. DOI: 10.1134/S0012266111050016.
12. Perov A. I. Frequency tests for the existence of boundary solutions. *Differential Equations*, 2007, vol. 43, no. 7, pp. 916–924. DOI: 10.1134/S001226610707004X.
13. Perov A. I. Frequency methods in the theory of bounded solutions of nonlinear  $n^{\text{th}}$ -order differential equations (existence, almost periodicity, and stability). *Differential Equations*, 2012, vol. 48, no. 5, pp. 670–680. DOI: 10.1134/S0012266112050059.
14. Baskakov A. G. On correct linear differential operators. *Sbornik : Mathematics*, 1999, vol. 190, no. 3, pp. 323–348. DOI: 10.1070/SM1999v190n03ABEH000390.
15. Baskakov A. G. Analysis of linear differential equations by methods of the spectral theory of difference operators and linear relations. *Russian Math. Surv.*, 2013, vol. 68, no. 1, pp. 69–116. DOI: RM2013v068n01ABEH004822.
16. Baskakov A. G. Linear differential operators with unbounded operator coefficients and semigroups of bounded operators. *Math. Notes*, 1996, vol. 59, no. 6, pp. 586–593. DOI: 10.1007/BF02307207.
17. Baskakov A. G. Spectral analysis of differential operators and semi-groups of difference operators I. *Differential Equations*, 1996, vol. 33, no. 10, pp. 1299–1306 (in Russian).
18. Baskakov A. G. Spectral analysis of differential operators and semi-groups of difference operators II. *Differential Equations*, 2001, vol. 37, no. 1, pp. 1–10. DOI: 10.1023/A:1019298028556.
19. Baskakov A. G., Sintyayev Yu. N. Finite-difference operators in the study of differential operators: Solution estimates. *Differential Equations*, 2010, vol. 46, no. 2, pp. 214–223. DOI: 10.1134/S0012266110020072.