

COMPLEX SYMMETRIC TRIANGULAR OPERATORS

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Abstract. In this paper we explore complex symmetric operators with eigenvalues. We develop new techniques to give a geometric description of certain complex symmetric triangular operators. This extends a recent result of L. Balayan and S. Garcia concerning finite-dimensional complex symmetric operators. On the other hand, using Apostol's triangular representation for Hilbert space operators, we give a description of the internal structure of complex symmetric operators.

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REFERENCES

- [1] C. APOSTOL AND B. B. MORREL, *On uniform approximation of operators by simple models*, Indiana Univ. Math. J. **26**, 3 (1977), 427–442.
- [2] L. BALAYAN AND S. R. GARCIA, *Unitary equivalence to a complex symmetric matrix: geometric criteria*, Oper. Matrices **4**, 1 (2010), 53–76.
- [3] N. CHEVROT, E. FRICAIN, AND D. TIMOTIN, *The characteristic function of a complex symmetric contraction*, Proc. Amer. Math. Soc. **135**, 9 (2007), 2877–2886 (electronic).
- [4] M. J. COWEN AND R. G. DOUGLAS, *Complex geometry and operator theory*, Acta Math. **141**, 3–4 (1978), 187–261.
- [5] K. R. DAVIDSON AND D. A. HERRERO, *The Jordan form of a bitriangular operator*, J. Funct. Anal. **94**, 1 (1990), 27–73.
- [6] S. R. GARCIA, *The norm and modulus of a Foguel operator*, Indiana Univ. Math. J. **58**, 5 (2009), 2305–2316.
- [7] S. R. GARCIA AND D. E. POORE, *On the norm closure of the complex symmetric operators: compact operators and weighted shifts*, J. Funct. Anal. **264**, 3 (2013), 691–712.
- [8] S. R. GARCIA, D. E. POORE, AND J. E. TENER, *Unitary equivalence to a complex symmetric matrix: low dimensions*, Linear Algebra Appl. **437**, 1 (2012), 271–284.
- [9] S. R. GARCIA, D. E. POORE, AND M. WYSE, *Unitary equivalence to a complex symmetric matrix: a modulus criterion*, Oper. Matrices **2**, 5 (2011), 273–287.
- [10] S. R. GARCIA AND M. PUTINAR, *Complex symmetric operators and applications*, Trans. Amer. Math. Soc. **358**, 3 (2006), 1285–1315 (electronic).
- [11] S. R. GARCIA AND M. PUTINAR, *Complex symmetric operators and applications. II*, Trans. Amer. Math. Soc. **359**, 8 (2007), 3913–3931 (electronic).
- [12] S. R. GARCIA AND W. ROSS, *Recent progress on truncated Toeplitz operators*, Fields Institute Communications **65** (2013), 275–319.
- [13] S. R. GARCIA, W. ROSS, AND W. R. WOGEN, *C^* -algebras generated by truncated Toeplitz operators*, Oper. Theory. Adv. Appl. **236** (2013), 181–192.
- [14] S. R. GARCIA AND J. E. TENER, *Unitary equivalence of a matrix to its transpose*, J. Operator Theory **68**, 1 (2012), 179–203.
- [15] S. R. GARCIA AND W. R. WOGEN, *Complex symmetric partial isometries*, J. Funct. Anal. **257**, 4 (2009), 1251–1260.
- [16] S. R. GARCIA AND W. R. WOGEN, *Some new classes of complex symmetric operators*, Trans. Amer. Math. Soc. **362**, 11 (2010), 6065–6077.

- [17] T. M. GILBREATH AND W. R. WOGEN, *Remarks on the structure of complex symmetric operators*, Integral Equations Operator Theory **59**, 4 (2007), 585–590.
- [18] P. R. HALMOS, *A Hilbert Space Problem Book*, Second edition. Graduate Texts in Mathematics, 19. Encyclopedia of Mathematics and its Applications, 17. Springer-Verlag, New York-Berlin, 1982.
- [19] D. A. HERRERO, *Spectral pictures of operators in the Cowen-Douglas class $B_n(\Omega)$ and its closure*, J. Operator Theory **18**, 2 (1987), 213–222.
- [20] D. A. HERRERO, *Most quasitriangular operators are triangular, most biquasitriangular operators are bitriangular*, J. Operator Theory **20**, 2 (1988), 251–267.
- [21] D. A. HERRERO, *Approximation of Hilbert space operators. Vol. 1*, 2nd Edition, Vol. 224 of Pitman Research Notes in Mathematics Series, Longman Scientific & Technical, Harlow, 1989.
- [22] D. A. HERRERO, *Triangular operators*, Bull. London Math. Soc. **23**, 6 (1991), 513–554.
- [23] D. SARASON, *Algebraic properties of truncated Toeplitz operators*, Oper. Matrices **1**, 4 (2007), 491–526.
- [24] S. ZHU, *Approximate unitary equivalence to skew symmetric operators*, Complex Analysis and Operator Theory **8**, 7 (2014), 1565–1580.
- [25] S. ZHU AND C. G. LI, *Complex symmetry of a dense class of operators*, Integral Equations Operator Theory **73**, 2 (2012), 255–272.
- [26] S. ZHU AND C. G. LI, *Complex symmetric weighted shifts*, Trans. Amer. Math. Soc. **365**, 1 (2013), 511–530.