Spectral properties of a non-selfadjoint differential operator with block-triangular operator coefficients

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In the study of the connection between spectral and oscillation properties of non-self-adjoint differential operators with block-triangular operator coefficients (see [1]) the question arises of the structure of the spectrum of such operators. In spite of the fact that the differential operator with block-triangular coefficients is non-self-adjoint, under certain conditions its spectrum can be real. At the same time, a non-self-adjoint operator, unlike a self-adjoint operator, can have points at which the resolvent has a pole, but which are not eigenvalues of the operator. They are called spectral singularities.

For an operator with a triangular matrix potential decreasing at infinity, which has a bounded first moment, the structure of the spectrum was established in the works of F.S. Rofe - Beketov and E.N. Bondarenko.

In this work we have obtained sufficient conditions under which the spectrum of a non-self-adjoint differential operator with block- triangular operator potential growing at infinity is real and discrete. The operator has no spectral singularities and its spectrum coincides with the union of the spectra of semibounded self-adjoint operators corresponding to self-adjoint diagonal elements. In this case, the growth rate of elements not standing on the main diagonal is subordinated to the growth rate of the diagonal elements. If these conditions are violated, the appearance of points of spectral singularities is possible. An example is given in [2].

[1] Kholkin A. M., Rofe-Beketov F. S. Sturm type oscillation theorems for equations with block-triangular matrix coefficients.// Meth. of Func. Anal. Topol. –2012. –18(2). –pp. 176-188.

[2] Kholkin A.M. Spectral singularities of differential operators with triangular matrix coefficients. // Meth. of Func. Anal. Topol. − 2013. − 19 (3). − pp. 260 - 267.