

Spectral Theory of Block Operator Matrices and Applications

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DEFINITION. The block numerical range of an $n \times n$ block operator matrix $A \in L(\mathcal{H})$ is the set

$$W^*(A) := \bigcup_{x \in \mathcal{S}^n} \sigma(A_x).$$

Here $\mathcal{H} = H_1 \times \dots \times H_n$ is the product of the Hilbert spaces

H_1, \dots, H_n , the operator A has the representation

$$A = \begin{pmatrix} A_{11} & & & \\ & \ddots & & \\ & & A_{nn} & \\ & & & \ddots \end{pmatrix}$$

with $A_{ij} \in L(H_{i+1}, H_j)$.

$$A_x := \begin{pmatrix} (A_{11}x_1, x_1) & & & \\ & \ddots & & \\ & & (A_{nn}x_n, x_1) & \\ & & & \ddots \\ (A_{11}x_1, x_n) & \cdots & (A_{nn}x_n, x_n) \end{pmatrix} \in M_n(\mathbb{C})$$

for $x \in \mathcal{S}^n := \{(x_1, \dots, x_n) \in \mathcal{H} : \|x_1\| = \dots = \|x_n\| = 1\}$,
and $\sigma(A_x)$ denotes the set of eigenvalues of the matrix A_x .

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This book presents new concepts in operator theory and covers classes of operators (in particular, non-selfadjoint operators) which exhibit various interesting phenomena. Special attention is paid to applications in many areas of mathematical physics, including quantum mechanics, fluid mechanics, and magnetohydrodynamics. The author also discusses an operator theoretic approach to spectral problems for linear operators admitting a certain block structure. The results apply to bounded or finite-dimensional operators like block matrices as well to unbounded operators describing systems of differential equations. New concepts of numerical range are developed.

作者介绍:

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