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STRUCTURED TOOLS FOR STRUCTURED MATRICES*

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Abstract. An extensive and unified collection of structure-preserving transformations is presented and organized for easy reference. The structures involved arise in the context of a non-degenerate bilinear or sesquilinear form on $\mathbb{R}^n$ or $\mathbb{C}^n$. A variety of transformations belonging to the automorphism groups of these forms, that imitate the action of Givens rotations, Householder reflectors, and Gauss transformations are constructed. Transformations for performing structured scaling actions are also described. The matrix groups considered in this paper are the complex orthogonal, real, complex and conjugate symplectic, real perplectic, real and complex pseudo-orthogonal, and pseudo-unitary groups. In addition to deriving new transformations, this paper collects and unifies existing structure-preserving tools.

Key words. Structured matrices, Matrix groups, Givens rotations, Householder reflections, Complex orthogonal, Symplectic, Complex symplectic, Conjugate symplectic, Real perplectic, Pseudo-orthogonal, Complex pseudo-orthogonal, Pseudo-unitary, Scalar product, Bilinear form, Sesquilinear form, Automorphism groups, Jordan algebra, Lie algebra.

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