

Identifying conditions for multilinear matrix equations to always hold with applications

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Abstract

Any algebraic expression that involves variables may vary with respect to the choice of the variables. Thus one of the fundamental problems in algebra is to determine conditions under which a given algebraic expression does not change with respect to the choice of variables in it. In my talk, I introduce a block matrix representation method to display necessary and sufficient conditions for the following two general multilinear matrix equations

$$(A_1 + B_1 X_1 C_1)(A_2 + B_2 X_2 C_2) \cdots (A_k + B_k X_k C_k) = M,$$

$$(A_1 + B_1 X_1 C_1 + D_1 Y_1 E_1) \cdots (A_k + B_k X_k C_k + D_k Y_k E_k) = M$$

to always hold respectively with respect to all variable matrices X_1, \dots, X_k and Y_1, \dots, Y_k . I then present some concrete examples on establishing such kinds of multilinear matrix identities in matrix theory with emphasis on characterizing numerous matrix identities and matrix set inclusions composed by generalized inverses.

Keywords

multilinear matrix equations, block matrix, matrix set inclusions, generalized inverses.