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Conditions on Expressing a Matrix as a Sum of α-Involutions

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Abstract : Let F be C or R, where C and R are the set of complex numbers and real numbers, respectively, and n be a natural number. An n-by-n matrix A over the field F is called an α-involutory matrix or an α-involution if there exists an α in the field such that the square of the matrix is equal to αI, where I is the n-by-n identity matrix. If α is a complex number or a nonnegative real number, then an n-by-n matrix A over the field F can be written as a sum of n-by-n α-involutory matrices over the field F if and only if the trace of that matrix is an integral multiple of the square root of α. Meanwhile, if α is a negative real number, then a 2n-by-2n matrix A over R can be written as a sum of 2n-by-2n α-involutory matrices over R if and only the trace of the matrix is zero. Some other properties of α-involutory matrices are also determined

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