Generic matrix superpotentials

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A simple and algorithmic description of matrix shape invariant potentials is presented. The complete lists of generic matrix superpotentials of dimension 2×2 and of special superpotentials of dimension 3×3 are given explicitly. In addition, a constructive description of superpotentials realized by matrices of arbitrary dimension is presented. In this way an extended class of integrable systems of coupled Schr\"odinger equation is classified. Examples of such systems are considered in detail. New integrable multidimensional models which are reduced to shape invariant systems via separation of variables are presented also.

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