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R-Matrix Method Using the Polar Form of the Schroedinger Operator CHARLES WEATHERFORD, Florida AM University — Any linear operator ($\hat{A}$) can be decomposed into a product of an Hermitian times a Unitary operator [P-O Löwdin, **Linear Algebra for QuantumTheory**,Wiley 1998, New York], as per $\hat{A} \equiv \hat{H}_1\hat{U}_1 = \hat{U}_2\hat{H}_2$ where $\hat{H}_1 = (\hat{A}\hat{A}^\dagger)^{1/2}$, $\hat{U}_1 = \hat{H}_1^{-1}\hat{A}$, $\hat{H}_2 = (\hat{A}^\dagger\hat{A})^{1/2}$, $\hat{U}_2 = \hat{A}\hat{H}_2^{-1}$. Such decompositions constitute what is called the polar form of the operator. A version of the R-matrix scattering theory will be presented employing the polar form of the time-independent Schroedinger operator (SO). The SO is not Hermitian in the continuum within the finite R-matrix sphere. An approximate inverse of the SO is constructed by diagonalizing its positive definite Hermitian component. An approximate expression for the scattered wave is obtained by projecting onto these eigenstates. In the process, a new type of minimum principal obtains such that minimization of the positive definite eigenvalues produces the most rapidly convergent series for the operator inverse and therefore, the solution. This algorithm is described and applied to several model problems which constitute a proof of principle.

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