

Abstract Submitted
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Four-level and two-qubit systems, sub-algebras, and unitary integration A.R.P. RAU, G. SELVARAJ, D. USKOV, Louisiana State University — Four-level systems in quantum optics, and for representing two qubits in quantum computing, are difficult to solve for general time-dependent Hamiltonians. A systematic procedure is presented which combines analytical handling of the algebraic operator aspects with simple solutions of classical, first-order differential equations. In particular, by exploiting $\mathfrak{su}(2) \times \mathfrak{su}(2)$ and $\mathfrak{su}(2) \times \mathfrak{su}(2) \times \mathfrak{u}(1)$ sub-algebras of the full $SU(4)$ dynamical group of the system, the non-trivial part of the final calculation is reduced to a single Riccati (first order, quadratically nonlinear) equation, itself simply solved. Examples are provided of two-qubit problems from the recent literature, including implementation of two-qubit gates with Josephson junctions.

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