52nd Sanibel Symposium, University of Florida, February 19 –24, 2012.

Unified treatment of exactly-solvable Schrödinger equations with confluent-hypergeometric wavefunctions*.

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In quantum chemical calculations the development of methods to obtain exactly and quasi-exactly solvable Schrödinger equations for different potential models has been an important subject of research. At this regard, the Nikiforov-Uvarov method applied to the hypergeometric differential equation (DE) has become a standard tool of important relativistic and non-relativistic quantum problems in spite that such a method only apply for particular potential models. In the present work, we propose an alternative approach to transform a second-order DE, of Sturm-Liouville type, into a Schrödinger-like equation. As an useful application, we consider explicitly the case of the confluent-hypergeometric (CH) DE in order to standardize all potentials having CH eigenfunctions. That is, the proposed approach lets obtain a generalized potential model that contain as particular cases the Harmonic, Morse, Coulomb and others exactly-solvable potentials. Besides, due that the proposal is general, it can be straightforwardly applied to other DE as for example in the search of bound-states solutions for new potential models.

*). Work partially supported by projects UAM-AZC-CBI-232004 and 09, COFFA-SIP-IPN-20110242 and SNI-Conacyt, MEXICO.