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Autore	Soto-Eguibar Francisco
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Sommario/riassunto

This book provides an alternative approach to time-independent perturbation theory in non-relativistic quantum mechanics. It allows easy application to any initial condition because it is based on an approximation to the evolution operator and may also be used on unitary evolution operators for the unperturbed Hamiltonian in the case where the eigenvalues cannot be found. This flexibility sets it apart from conventional perturbation theory. The matrix perturbation method also gives new theoretical insights; for example, it provides corrections to the energy and wave function in one operation. Another notable highlight is the facility to readily derive a general expression for the normalization constant at m-th order, a significant difference between the approach within and those already in the literature. Another unique aspect of the matrix perturbation method is that it can be extended directly to the Lindblad master equation. The first and second-order corrections are obtained for this equation and the method is generalized for higher orders. An alternative form of the Dyson series, in matrix form instead of integral form, is also obtained. Throughout the book, several benchmark examples and practical applications underscore the potential, accuracy and good performance of this novel approach. Moreover, the method's applicability extends to some specific time-dependent Hamiltonians. This book represents a valuable addition to the literature on perturbation theory in quantum mechanics and is accessible to students and researchers alike.