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Autore	Hayden, Wayne
Titolo	Volume terzo: Proprietà meccaniche / Wayne Hayden, William G. Moffatt, John Wulff
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Descrizione fisica	xiv, 244 p. ; 22 cm
Altri autori (Persone)	Wulff, John Moffatt, William G.
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Autore	Froman Nanny
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Nota di bibliografia	Includes bibliographical references (p. 205-208) and indexes.
Nota di contenuto	1. Historical survey -- 1.1. Development from 1817 to 1926 -- 1.2. Development after 1926 -- 2. Description of the phase-integral method -- 2.1. Form of the wave function and the q-equation -- 2.2. Phase-integral approximation generated from an unspecified base function -- 2.3. F-matrix method -- 2.4. F-matrix connecting points on opposite sides of a well-isolated turning point, and expressions for the wave function in these regions -- 2.5. Phase-integral connection formulas for a real, smooth, single-hump potential barrier -- 3. Problems with solutions -- 3.1. Base function for the radial Schrodinger equation when the physical potential has at the most a Coulomb singularity at the origin -- 3.2. Base function and wave function close to the origin when the physical potential is repulsive and strongly singular at the origin -- 3.3. Reflectionless potential -- 3.4. Stokes and anti-Stokes lines -- 3.5. Properties of the phase-integral approximation along an anti-Stokes line -- 3.6. Properties of the phase-integral approximation along a path on which the absolute value of exp[iw(z)] is monotonic in the strict sense, in particular along a Stokes line -- 3.7. Determination of the Stokes constants associated with the three anti-Stokes lines that emerge from a well isolated, simple transition zero -- 3.8. Connection formula for tracing a phase-integral wave function from a Stokes line emerging from a simple transition zero t to the anti-Stokes line emerging from t in the opposite direction -- 3.9. Connection formula for tracing a phase-integral wave function from an anti-Stokes line emerging from a simple transition zero t to the Stokes line emerging from t in the opposite direction -- 3.10. Connection formula for tracing a phase-integral wave function from a classically forbidden to a classically allowed region -- 3.11. One-directional nature of the connection formula for tracing a phase-integral wave function from a classically forbidden to a classically allowed region -- 3.12. Connection formulas for tracing a phase-integral wave function from a classically allowed to a classically forbidden region -- 3.13. One-directional nature of the connection formulas for tracing a phase-integral wave function from a classically allowed to a classically forbidden region -- 3.14. Value at the turning point of the wave function associated with the connection formula for tracing a phase-integral wave function from the classically forbidden to the classically allowed region -- 3.15. Value at the turning point of the wave function associated with a connection formula for tracing the phase-integral wave function from the classically allowed to the classically forbidden region -- 3.16. Illustration of the accuracy of the approximate formulas for the value of the wave function at a turning point -- 3.17. Expression for the a-coefficients associated with the Airy functions -- 3.18. Expressions for the parameters [alpha], [beta] and [gamma] when Q[superscript 2](z) = R(z) = -z -- 3.19. Solutions of the Airy differential equation that at a fixed point on one side of the turning point are represented by a single, pure phase-integral function, and their representation on the other side of the turning point -- 3.20. Connection formulas and their one-directional nature demonstrated for the Airy differential equation -- 3.21. Dependence of the phase of the wave function in a classically allowed region on the value of the logarithmic derivative of the wave function at a fixed point X[subscript 1] in an adjacent classically forbidden region -- 3.22. Phase of the wave function in the classically allowed regions adjacent to a real, symmetric potential barrier, when the logarithmic derivative of the

wave function is given at the centre of the barrier -- 3.23. Eigenvalue problem for a quantal particle in a broad, symmetric potential well between two symmetric potential barriers of equal shape, with boundary conditions imposed in the middle of each barrier -- 3.24. Dependence of the phase of the wave function in a classically allowed region on the position of the point [chi][subscript 1] in an adjacent classically forbidden region where the boundary condition [psi][chi][subscript 1]) = 0 is imposed -- 3.25. Phase-shift formula -- 3.26. Distance between near-lying energy levels in different types of physical systems, expressed either in terms of the frequency of classical oscillations in a potential well or in terms of the derivative of the energy with respect to a quantum number -- 3.27. Arbitrary-order quantization condition for a particle in a single-well potential, derived on the assumption that the classically allowed region is broad enough to allow the use of a connection formula -- 3.28. Arbitrary-order quantization condition for a particle in a single-well potential, derived without the assumption that the classically allowed region is broad -- 3.29. Displacement of the energy levels due to compression of an atom (simple treatment) -- 3.30. Displacement of the energy levels due to compression of an atom (alternative treatment) -- 3.31. Quantization condition for a particle in a smooth potential well, limited on one side by an impenetrable wall and on the other side by a smooth, infinitely thick potential barrier, and in particular for a particle in a uniform gravitational field limited from below by an impenetrable plane surface -- 3.32. Energy spectrum of a non-relativistic particle in a potential proportional to cot[superscript 2]([chi]/a[subscript 0]), where 0 < [chi]/a[subscript 0] < [pi] and a[subscript 0] is a quantity with the dimension of length, e.g. the Bohr radius -- 3.33. Determination of a one-dimensional, smooth, single-well potential from the energy spectrum of the bound states -- 3.34. Determination of a radical, smooth, single-well potential from the energy spectrum of the bound states -- 3.35. Determination of the radial, single-well potential, when the energy eigenvalues are -mZ[superscript 2]e[superscript 4]/[2[actual symbol not reproducible][superscript 2]([iota]+s+1)[superscript 2]], where [iota] is the angular momentum quantum number, and s is the radial quantum number -- 3.36. Exact formula for the normalization integral for the wave function pertaining to a bound state of a particle in a radial potential -- 3.37. Phase-integral formula for the normalized radial wave function pertaining to a bound state of a particle in a radial single-well potential -- 3.38. Radial wave function [psi](z) for as s-electron in a classically allowed region containing the origin, when the potential near the origin is dominated by a strong, attractive Coulomb singularity, and the normalization factor is chosen such that, when the radial variable z is dimensionless, [psi](z)/z tends to unity as z tends to zero -- 3.39. Quantization condition, and value of the normalized wave function at the origin expressed in terms of the level density, for as s-electron in a single-well potential with a strong attractive Coulomb singularity at the origin -- 3.40. Expectation value of an unspecified function f(z) for a non-relativistic particle in a bound state -- 3.41. Some cases in which the phase-integral expectation value formula yields the expectation value exactly in the first-order approximation -- 3.42. Expectation value of the kinetic energy of a non-relativistic particle in a bound state. Verification of the virial theorem -- 3.43. Phase-integral calculation of quantal matrix elements -- 3.44. Connection formula for a complex potential barrier -- 3.45. Connection formula for a real, single-hump potential barrier -- 3.46. Energy levels of a particle in a smooth double-well potential, when no symmetry requirement is imposed -- 3.47. Energy levels of a particle in a smooth,

symmetric, double-well potential -- 3.48. Determination of the quasi-stationary energy levels of a particle in a radial potential with a thick single-hump barrier -- 3.49.
Transmission coefficient for a particle penetrating a real single-hump potential barrier -- 3.50. Transmission coefficient for a particle penetrating a real, symmetric, superdense double-hump potential barrier.

Sommario/riassunto

This book provides a thorough introduction to one of the most efficient approximation methods for the analysis and solution of problems in theoretical physics and applied mathematics. It is written with practical needs in mind and contains a discussion of 50 problems with solutions, of varying degrees of difficulty. The problems are taken from quantum mechanics, but the method has important applications in any field of science involving second order ordinary differential equations. The power of the asymptotic solution of second order differential equations is demonstrated, and in each case the authors clearly indicate which concepts and results of the general theory are needed to solve a particular problem. This book will be ideal as a manual for users of the phase-integral method, as well as a valuable reference text for experienced research workers and graduate students.