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Analysis of Munk waveguide normal modes based on the Rayleigh-Schrödinger perturbation and adiabatic invariant theories

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This work concerns to obtain accurate explicit formulas related to discrete spectrum of the Munk deepwater acoustic wave guide problem. To this end, based on the Rayleigh-Schrödinger perturbation theory, we developed analytic results related to the discrete values of the radial wave numbers as well as to the eigen pressure felds. We compare these previous results with JWKB ones. In addition, based on invariant adiabatic theory to wave equation [1,2], we tried to improve the accuracy of the JWKB calculation applying Olver's uniform asymptotic expansion (UAE) theory for the solution of the second-order differential equation with two turning points [3-5]. Comparing these three above particular frameworks, we conclude that UAE theory is accurate and it well describes the Munk wave guide normal modes. [1] L M Brekhovskikh and Yu P Lysanov, Fundamentals of Ocean Acoustics, Spinger, NY, 2001. [2] B G Katsnelson and V G Petnikov, Shallow Water Acoustics. Spinger, UK, 2002. [3] F W J Olver, Asymptotics and special functions, Academic Press, London, 1974. [4] L. G. Guimarães and H. M. Nussenzveig, J. Mod. Optic., 41:625, 1994. [5] P. C. G. de Moraes and L. G. Guimarães, JQSRT, 74:757, 2002.