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Parabasal formulas and their applications

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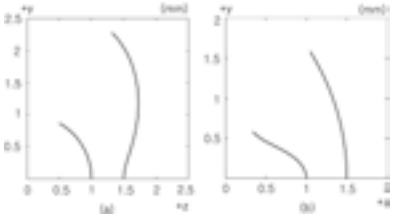
Parabasal theory is a technique in geometrical optics that describes the behavior of light rays located near some defined base ray rather than the optical axis. In this work, we are concerned with parabasal rays which lie in a sufficiently small neighborhood of a chief ray and develop some formulas for parabasal quantities of the chief ray. Parabasal quantities of a chief ray are shown to be intimately related to the coefficients of first order differential equations of the chief ray. Using the relations, we derive parabasal formulas containing parabasal refractive indices and parabasal powers from the first order differential equations. These parabasal formulas turn out to be decoupled differential equations of the first order differential equations so that highly coupled differential equations for a chief ray can be solved systematically. In addition, we apply parabasal formulas to the paraxial region by taking the limits of the formulas. These limits give necessary conditions expressed in terms of Gaussian brackets for various initial design requirements of optical lens systems. Those necessary conditions do not seem to be derivable by using only paraxial theory without parabasal approaches developed in this work.



Biography

Sunggoo Cho completed his PhD in the year 1989 from University of Maryland, College Park, USA. As a student of the physics department, he wrote his PhD thesis on “supermanifold” under the supervision of Dr P Green in the department of mathematics. After Post-doctoral research at Sogang University, South Korea, he had worked as a Professor at the Department of Physics of Semyung University from 1991 to 2005 as a pure mathematical physicist. Now he is a Professor at the School of Computer Science of Semyung University teaching game programming and deep learning. He has developed a couple of commercial software with a team of students. In addition, he is a researcher and developer at the Light and Math Inc. at Semyung University and has more than 20 patents. He has also developed several computer programs for optical applications such as interferometer program with noisy fringe patterns for Prooptics Inc. in South Korea. He has executed more than 15 commercial projects for several companies. He is currently working on deep learning and its applications to optics and computer vision.

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