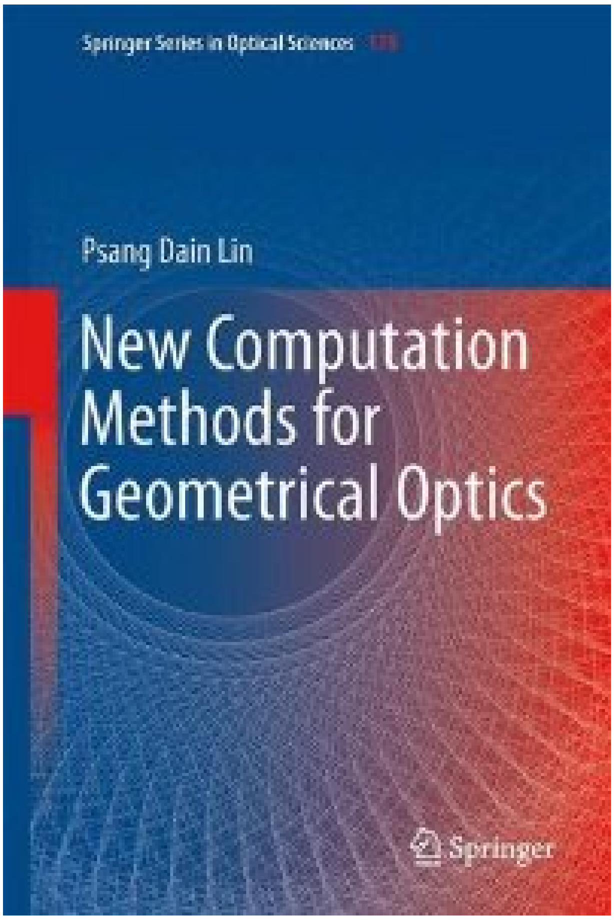
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New Computation Methods for Geometrical Optics
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abstract

The traditional geometrical optics is based on raytracing only. It is very difficult, if possible, to compute the first- and second-order derivatives of a ray and optical path length with respect to system variables, since they are recursive functions. Consequently, current commercial software packages use a finite difference approximation methodology to estimate these derivatives for use in optical design and analysis. Furthermore, previous publications of geometrical optics use vector notation, which is comparatively awkward for computations for non-axially symmetrical systems. In order to circumvent these limitations, this book employs homogeneous coordinate notation to compute the first- and second-order derivative matrices of various optical quantities. It will be one of the important mathematical tools for system analysis and automatic optical design.

This book is dedicated to Department of Mechanical Engineering, National Cheng Kung University in Taiwan. It is almost impossible to complete this book without its wonderful environment. My special thanks are also delivered to National Science Council of Taiwan for its financial supports every year.

中文摘要

過去學者一直倚賴「歪斜光線追蹤方程式」，對光學系統進行分析與設計。但「歪斜光線追蹤方程式」是高度且多重變數的複合函數。而且過去幾何光學都使用「向量」當數學工具，向量是比較簡單易懂，但當光學邊界很複雜時，向量會較笨拙。所以過去都用「差分法」計算其第一階微分（賈可比矩陣）與第二階微分（漢森矩陣）。但「差分法」會有下列三個缺點：(1)分母較大時，失去線性的性質；(2) 分母很小時，會失去精確度；(2) 差分法需做多次的光線追蹤。為了克服此些困難，吾人就用「齊次座標」當成數學工具，對「歪斜光線追蹤方程式」作第一階微分與第二階微分，吾人並且將該矩陣應用於光學系統最佳化、調變函數、點擴散函數、波前曲面、焦散面、照度的計算，都得到很好的效果。吾人確信它將是幾何光學的重要工具。最後，我將本書獻給成大機械系，因為它優越的環境，讓我得以完成此書。並且感謝國科會每年的補助。