

论文

椭圆函数的精细积分改进算法

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摘要:

椭圆函数是一种特殊的双周期复变函数, 广泛应用于工程问题中, 尤其非线性问题中居多. 在工程中遇到的椭圆函数以二阶椭圆函数为主, 而且很多复杂的椭圆函数都可以通过变换由二阶椭圆函数得到. 二阶椭圆函数包括Jacobi椭圆函数和Weierstrass椭圆函数. 它们都可以进行幂级数展开, 直接计算很不方便. 椭圆函数的重要性质之一就是具有加法定理, 因此可利用精细积分法求解. 虽然椭圆函数的精细积分算法在精度和效率上取得了较大成功, 但椭圆函数的奇点问题仍然存在并对计算精度构成一定威胁. 在回顾并分析椭圆函数的精细积分算法的基础上, 通过对椭圆函数奇点的分析, 给出了椭圆函数可去奇点的近似公式, 并在此基础上进一步改进并完善了椭圆函数的精细积分算法.

关键词: 精细积分, Jacobi椭圆函数, 双周期, 奇点, 可去奇点

THE IMPROVED PRECISE INTEGRATION METHOD FOR ELLIPTIC FUNCTIONS

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Abstract:

Elliptic functions are a special kind of double period complex functions and are used in engineering widely, especially in nonlinear problems. Many elliptic functions in engineering problems are second order elliptic functions, and many complicated elliptic functions are found to be obtained from second order elliptic functions. The most familiar second order elliptic functions include Jacobi elliptic functions and Weierstrass elliptic functions. They can be expressed as power series expansion, directly calculating is inconvenient. One of the most important properties of elliptic functions is the additional theorem, so that the method of precise integration can be invoked. Although the precise integration method of elliptic functions has achieved many successes in precision and efficiency, but the singularity problem is still a big enemy of precision. The precise integration method of Jacobi elliptic function is reviewed first. The approximate formulae of removable singularity are deduced after analyzing of the singularity. Then the improved precise integration method is presented based on those formulae and analyses.

Keywords: Precise integration method, Jacobi elliptic function, double periods, singularity, Removable Singularity

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