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重力学与大地测量学

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## 扰动重力梯度张量单分量和组合分量最小二乘配置法模型的建立

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Construction of the least squares collocation models for single component and composite components of disturbed gravity gradients

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摘要

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摘要 建立了利用扰动重力梯度张量 $T_{zz}$ 分量和 $T_{xx}+T_{yy}$ 、 $T_{zz}-T_{xx}-T_{yy}$ 组合分量确定地球重力场的调和分析法模型,进一步推导了扰动重力梯度张量对角线三分量的自协方差和互协方差函数的级数展开式,推导了单分量、组合分量与重力位系数之间协方差函数的实用计算公式,给出了利用单分量和组合分量解算地球重力场模型的最小二乘配置法基本原理公式.结果表明,最小二乘配置法具有一定的抗差能力,随着观测数据误差的不断增大,其恢复的重力场模型有效阶次不断降低,精度也不断下降; $T_{zz}-T_{xx}-T_{yy}$ 组合分量解算重力场模型的精度最高,其次为 $T_{zz}$ 分量, $T_{xx}+T_{yy}$ 组合分量最差.

关键词 地球重力场模型, 调和分析法, 最小二乘配置法, 卫星重力梯度, GOCE

Abstract: This work constructs the spherical harmonic analysis models for single component  $T_{zz}$  and composite components  $T_{xx}+T_{yy}$ ,  $T_{zz}-T_{xx}-T_{yy}$  of disturbed gravity gradients to compute earth's gravitational field model (EGM). Besides, the series expansion formulae of variance and covariance functions of the diagonal components of disturbed gravity gradients are deduced. Then, the practical computational formulae of covariance functions between single component, composite components and the gravity potential coefficients are deduced. Finally, this work presents the fundamental formula of the least squares collocation (LSC) to compute EGM using the single component and composite components. The results show that the LSC is robust to a certain extent and the effective degree and precision of EGM decay gradually with the increase of errors. The precision of the EGM computed by the composite components  $T_{zz}-T_{xx}-T_{yy}$  is the best, while that of the composite components  $T_{xx}+T_{yy}$  is the least.

Keywords Earth's gravitational field model(EGM), Spherical harmonic analysis method, Least squares collocation (LSC), Satellite gravity gradient(SGG), GOCE

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