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应用Bjerhammar方法确定GPS重力似大地水准面

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Determination of GPS/gravity quasi-geoid using the Bjerhammar method

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摘要 GPS技术的发展提出了新的大地边值问题——GPS重力边值问题.本文将Bjerhammar方法应用于GPS重力问题的求解,并在给出理论公式的基础上,针对实际计算中虚拟场元的分布和求解、虚拟球半径的确定及奇异积分等问题提出了具体的解决方案.文中通过比例因子*k*在虚拟球半径和GPS重力数据密度间建立起联系,并推导出其近似值.在此基础上,利用收集到的某地区的4870个GPS重力数据计算了该地区的似大地水准面,65个高精度GPS水准点进行的外部检核表明其精度为±2.4 cm.经二次多项式拟合后,另外29个GPS水准点外部检核精度达到±1.4 cm.不同分辨率GPS重力数据的计算结果表明,尽管比例因子*k*的近似值不是最优值,但其对重力场逼近效果影响不是很大.这些结果说明了将Bjerhammar方法应用于GPS重力边值问题求解的合理性及本文计算方法的可行性和可靠性.

关键词: GPS重力边值问题 Bierhammer方法 似大地水准面 精度分析

Abstract: The GPS/gravity boundary varue problem(BVP) is proposed as a new geodetic boundary value problem with the development of GPS technology. In this paper, the Bjerhammar method is used to solve the GPS/gravity BVP. Based on the theoretical formulas, a detailed computational procedure is presented for some problems confronted in the application of the Bjerhammar method , such as the distribution and the solution of fictitious gravity quantities, the determination of fictitious spherical radius and singular integral. A scale factor *k* is used to build relationship between the fictitious spherical radius and the resolution of GPS/gravity data points. Based on the methods, a local quasi-geoid is determined by using 4870 GPS/gravity data points with precision checking with 65 high accuracy GPS/leveling points is ±2.4cm. After matching with GPS/leveling data using quadratic polynomial fitting, its precision checking with other 29 GPS/leveling data is ±1.4cm. The result calculated using GPS/gravity data with different resolutions indicates that approximation of the scale factor *k* is reasonable, though it is not the optimal value. The results all above show the rationality of the Bierhammer method used for the solution of GPS/gravity BVP and the feasibility and reliability of the computational procedure used in this paper.

Keywords: GPS/gravity BVP Bjerhammer method Quasi-geoid Accuracy analysis

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