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基于改进型UDVT分解的单频整周模糊度快速解算

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Algorithm of Rapid Integer Ambiguity Resolution for Single Frequency GPS Receivers Based on Improved UDVT Decomposition

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摘要 基于全球定位系统(GPS)快速定位中观测矩阵的病态性特点和Tikhonov正则化原理,研究了单频整周模糊度快速解算的改进方法.基于奇异值扰动理论,研究了改进型UDVT分解算法,即利用病态观测矩阵构造新的矩阵,然后化为上Hessenberg形式的三对角矩阵,利用移位QR算法得到精确的奇异值,避免了因较小奇异值发生较大抖动而使正则化矩阵出现不稳定的情况;在分析法矩阵病态性特点的基础上,设计了改善正则化矩阵的构造方法.实验结果表明,与传统最小二乘降相关平差(LAMBDA)算法和Tikhonov正则化-LAMBDA法相比,新算法能更有效地改善法矩阵的病态性,只利用3～5个历元即能实现模糊度浮点解的快速解算及其固定,且结果可靠,浮点值更加接近真实值.

关键词: 全球定位系统 整周模糊度 浮点值 病态矩阵 UDVT分解 改善正则化矩阵

Abstract: Based on the ill-condition observation matrix and the principle of Tikhonov regularizer algorithm, an improved method of global positioning system (GPS) rapid ambiguity resolution using single frequency receivers is studied. Based on the wobble principle of singular values, an improved algorithm of UDVT decomposition is proposed. A new matrix is constructed by the observation matrix, and turned to upper Hessenberg 3-diagonal-matrix. Then accurate singular values are acquired using the shifting QR algorithm, and the non-stabilization of the regularizer matrix is avoided which is caused by small singular values. The improved regularizer matrix is deduced and the construction method is designed based on an analysis of the characteristics of the ill-condition matrix. Experiment results indicate that the improved method is more effective on improving ill-condition observation matrices as compared with the conventional least-squares ambiguity decorrelation adjustment (LAMBDA) algorithm and Tikhonov regularizer-LAMBDA algorithm, and more precise floating-point and fixing-point are acquired quickly and reliably by just 3-5 epochs.

Keywords: global positioning system integer ambiguity floating-point ill-condition matrix UDVT decomposition improved regularizer matrix

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