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制导、导航与控制

基于星载双频GPS的长基线卫星编队 高精度快速星间相对定位

涂佳, 谷德峰, 吴翊, 易东云

国防科学技术大学理学院数学与系统科学系, 湖南 长沙 410073

摘要:

国际全球导航卫星系统服务(international GNSS service, IGS)精密星历产品的产生时间较长和一阶差分电离层延迟影响是长基线卫星编队利用星载双频全球定位系统实现高精度快速星间差分相对定位存在的两大问题。针对上述问题,提出了一种基于IGS超快速星历的动力学单差消电离层组合相对定位方法,该方法利用IGS超快速星历,加快数据准备;通过构建单差消电离层组合,消除一阶单差电离层延迟的影响。采用重力反演与气候实验卫星一周的观测数据进行相对定位实验,由K波段测距系统检核的结果为7.05 mm,与采用精密星历的精度相当,从而验证了利用本方法可以快速实现长基线卫星编队毫米级相对定位。

关键词: 卫星编队 相对定位 长基线 单差消电离层组合 超快速星历

Precise and rapid inter-satellite relative positioning for long baseline satellite formation using onboard dual-frequency GPS

TU Jia, GU De-feng, WU Yi, YI Dong-yun

Department of Mathematics and System Sciences, College of Sciences, National University of Defense Technology, Changsha 410073, China

Abstract:

The long latency of international GNSS service (IGS) final ephemerides and the influence of the first order differential ionospheric path delay are two problems of precise and rapid inter-satellite differential relative positioning for long baseline satellite formation using dual-frequency global positioning system (GPS). To deal with these problems, a dynamic single difference ionosphere free combination relative positioning method based on IGS ultra-rapid ephemerides is proposed. In this method, IGS ultra-rapid ephemerides are selected to expedite the data preparations of relative positioning. The influence of the first order single difference ionospheric path delay is eliminated by constructing single difference ionosphere free combination. Experiments of relative positioning are carried on the one-week observation data of the gravity recovery and climate experiment (GRACE) satellites. The result validated by K-band ranging system (KBR) observation data is 7.05 mm, which is equivalent to the precision obtained by IGS final ephemerides. It proves that this method can be used to realize the rapid relative positioning for long baseline satellite formation at mm level.

Keywords: satellite formation relative positioning long baseline single difference ionosphere free combination ultra-rapid ephemerides

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通讯作者:

作者简介:

作者Email:

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