شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

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جامعة عين شمس

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قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

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Assessment of Integrating Global Navigation Satellite Systems (GNSS)

A Thesis Submitted to the Faculty of Engineering
Ain Shams University
for the Fulfillment of the Requirement of M. Sc. Degree
In Civil Engineering

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Date: 17/01/2022

Dedication

This thesis is dedicated to **MY PARENTS** who have given me this opportunity of education and supported me throughout my life, and their prayer for my success.

Also

It is dedicated to **MY BROTHERS**, and **SISTERS** who have encouraged and helped me to complete this work.

Statement

This dissertation is submitted to Ain Shams University, Faculty of Engineering, Public Works Department for the degree of M. Sc. in Civil Engineering.

The work included in this thesis was carried out by the author in the Department of Public Works, Faculty of Engineering, Ain Shams University, from 2017 to 2021.

No part of the thesis has been submitted for a degree or a qualification at any other University or Institution.

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Abstract

Over the last decades, a wide range of applications that require positions relied on the Global Positioning System (GPS) established by the US Department of Defence (DOD). Thus, relying on a single constellation may not be sufficient to guarantee a successful positioning accuracy at any time. Consequently, having several constellations that can be used for positioning offers the opportunity to maintain continuous positioning. This became possible with the global coverage of other constellations such as GLONASS, established by Russia, Galileo, established by the European Union, and BeiDou, launched by China.

In general, a more significant number of received satellite signals leads to better satellite geometry. Furthermore, multiple GNSS improve many applications. The orbit geometry is strengthened by the increased number of satellites, which leads to higher accuracy, reduction of the initialization times and improves overall availability.

In this research, the accuracy of using each of these constellations individually and their combination are assessed and compared to the accuracy obtained from GPS to validate the possibility of using these constellations in positioning in the absence of GPS.

Results of the detection process for cycle slip showed that graphical detection could be used as a primary detection

technique, whereas the statistical approaches of detection are proved to be superior. And results of the repairing process showed that any trial could be used for such a process except averaging all data for the 1st and 2nd-time differences as they give very low accuracy of the cycle slip fixation.

GNSS performance in Precise Point Positioning showed that the BeiDou PPP exhibits slightly worse performance than the GPS-only PPP due to the uncertainty of BDS precise orbits and clock solutions at the decimeter level, mainly because the BeiDou having a few satellites. Also, the combined system and Galileo-only positioning performance are better than the GPS-only and GLONASS-only. Additionally, it is noted that the combined system results show the best performance in the Egypt region and surrounding area, which is in the coverage of the current Galileo service. Overall, the combined system PPP without ambiguity resolution has shown the accuracy of better than 4 cm in the horizontal and 10 cm in the vertical components and 8 cm in the horizontal, and 11 cm in the vertical components by using precise orbits and broadcast orbits, respectively.

Finally, the results of the assessment of integrating Global Navigation Satellite Systems showed that using GLONASS-only or BeiDou-only positioning modes provides less accuracy than GPS-only mode in both horizontal and vertical directions. In addition, Galileo can be used to replace GPS as an individual positioning constellation. Moreover, using Galileo, GLONASS, and BeiDou together improves the positioning accuracy by 0.006 m over the GPS-only model. Therefore, the solution can reach