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بسم الله الرحمن الرحيم

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التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

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

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تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

بعض الوثائق الأصلية تالفة

بالرسالة صفحات لم ترد بالأصل

Comparative studies of some artificial satellites observations and fitting the output data using Spline technique.

A Thesis submitted
to
The Astronomy Department
Faculty of science
Cairo University

By

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In the Partial Fulfillment for the requirements of M.Sc. Degree

Cairo University
Faculty of Science

2004

APPROVAL SHEET

Title of the Ms.C Thesis

Comparative studies of some artificial satellites observations and fitting the output data using Spline technique

Submitted to:

The Astronomy Department, Faculty of science, Cairo University

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Keywords

Satellite laser Ranging (SLR), Traking, Helwan–SLR Station, Upgrading, Equipment, Calibration, Data Fitting, Spline, analysis procedures, Interpolation, Chebyshev polynomials, Precision, Standard deviation, Range, Range residuals.

Summary

The satellite laser ranging is considered to be one of the most accurate techniques available to track the artificial earth's satellites. The high precision measurements achieved at several SLR stations have resulted in many new and exiting science applications. Therefore, all SLR stations are concerned with improving the accuracy of the distance measurements by upgrading the used hardware and software.

In this thesis, the satellite laser ranging from Helwan-SLR station is studied; the upgrading, which has been made to the station, the analysis procedures used for analyzing the SLR data, and some comparative statistical studies on Helwan-SLR data are presented. In addition to that, one of the tasks in this work is to deal with the problem of fitness of data. Needless to say that the process of smoothing the SLR data is considered to be the first step for any analysis or further scientific study related to the satellite laser ranging. So, a method for analyzing the SLR data is applied using the spline technique in order to obtain what is the so-called best fitting.

Chapter one represents a historical background on the satellite laser ranging followed by the principles and the purposes of the satellite tracking using the laser beam. Also, some information about the satellites, which have been tracked from Helwan-SLR station, are represented. In addition to that, a historical review of Helwan-SLR station is given. The description and the upgrading of the equipment of the Helwan satellite laser ranging station are also given. The software and the hardware related to the system are explained followed by the method used for calibrating the system of the Helwan-SLR station. Moreover, this chapter gives a mathematical interpretation of the data

fitting followed by short notes about the spline technique from the points of view of its definition and its different kinds.

In chapter two, the satellite position prediction software, which is carried out to compute the location (or position) of the satellite and its corresponding range for each one-minute interval, is explained. The satellite laser ranging data and their analysis procedures from the Helwan-SLR station are also explained and the results of the data analysis are discussed. In addition to that, it is known that the SLR data are characterized by the huge number of data points. Therefore, one of the tasks of this chapter is to discuss the contraction of this large number of data points using the so-called normal points.

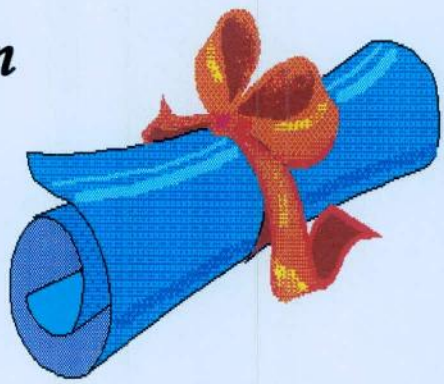
Chapter three deals with fitting satellite laser ranging data using the spline technique and its advantages for fitting a large number of data points, using the Chebyshev polynomial. The approximation with the Chebyshev polynomials is discussed. The principles of fitting data using the spline technique are explained. A constructed program for fitting data is represented. As an application, the spline technique is used for fitting each of the satellite laser ranging data and the on-line range residuals obtained from the observations of the satellites Ajisai, Topex, and Beacon-C. Finally, this chapter is ended by a comparison between the results obtained using the technique mentioned in chapter two (which is used in Helwan-SLR station) and their corresponding values obtained by applying the spline technique on the range residuals.

Comparative statistical studies on satellite laser ranging data are given in chapter four. The results of the analysis of the data taken before and after the upgrading, which have been made to the Helwan-SLR station during the year 1999, are shown. The results are compared with values of other

investigators from different analysis centers. Moreover, the number of passes and the number of normal points as computed for the satellites observed from Helwan-SLR station during the period from 1991 to 2001 are given. Finally, a comparative study of the results of the data obtained from the Helwan-SLR station with those obtained from other SLR network stations have been made.

Dedication

I would like to dedicate this thesis
with deepest love
to
My Father
My Mother
My Sister Magdolin
and
My Brother Isaac



Acknowledgment

I'm deeply indebted to Prof. Dr. Joseif Sedky Mikhail, National Research Institute of Astronomy and Geophysics (NRIAG), Space Research Lab., for his stimulating discussions, his critically and helpful reviewing and his continuous supporting throughout the course of this work.

I wish to express my deepest gratitude to Prof. Dr. Z.Metwally, Astronomy Dept., Faculty of Science, Cairo University, for his kind and sincere supervision and for encouraging me during the progress of the whole work.

I would like to express my deepest gratitude to Prof. Dr. Maher Melek, Astronomy Dept., Faculty of Science, Cairo University, for his truthful support, revision of this work, constructive criticism, and for his instructive scientific discussions.

I would like to express my sincere gratitude and deepest thanks to Dr. Yousry Shafik Hanna and Dr. Makram Ibrahim Khalil, National Research Institute of Astronomy and Geophysics (NRIAG), Space Research Lab., for their unlimited help, continuous guidance, valuable suggestions, fruitful discussions, and continuous support throughout this research.

I wish to thank the Astronomy Dept. at the Cairo University, and I'm greatly indebted to the Space Research Lab. and all the Staff in NRIAG for their help and doing their best and for providing me excellent facilities, which made the completion of this work possible.

I would like to express my heart felt gratitude, with deepest love and appreciation to my family and all the unnamed persons who inspired me all through the work.

Contents