

STATEMENT

by Prof. Dr. Eng. Keranka Vassileva,

concerning the dissertation

„GEODETIC EARTH OBSERVATIONS COMBINATION FOR VERTICAL REFERENCE SYSTEM DEFINITION – A CASE STUDY FOR THE KINGDOM OF SAUDI ARABIA VERTICAL DATUM AND VERTICAL REFERENCE FRAME“

for acquiring the educational and scientific degree "Doctor" in the professional field 5.7.

Architecture, Construction and Surveying, specialty „Surveying, geodesy and applied surveying”,

presented by Eng. Othman Al-Kherayef

Eng. Othman Al-Kherayef finished Engineering, Surveying Engineering at the Faculty of Engineering, King Saud University, Riyadh, Kingdom of Saudi Arabia (KSA) in 1991. He completed several training courses by 2007. He held various responsible positions up to end 2014 and since 2015 and present he is General Director for the General Directorate of Geodetic and Earth Survey (GCS). Eng. Othman Al-Kherayef was a project manager of the KSA-CORS project (Phase one) at GCS. He has participated and managed a number of geodetic tasks of national importance for Saudi Arabia (SA), member of different committees, obtained many awards. He has 9 co-authored publications and presentations for the 2014-2017 period. He has participated in a number of international surveying events since 2000 and has received several certificates.

Combining heterogeneous earth geodetic observations to estimate the geopotential numbers and orthometric heights of the tide gauges (TG), and therefore determining the vertical datum, and the corresponding precise vertical reference system is extremely relevant, but also a very complex problem to solve. Doctoral student Eng. Othman Al-Kherayef has addressed to this problem for the territory of Saudi Arabia, especially considering the location of SA between two water basins (the Persian Gulf and the Red Sea). He used extremely large number (11 types) heterogeneous observations and recent models (7.5 years of TG records at 12 TGs along Red Sea and Arabian Gulf coastal line, precise leveling data, orthometric heights, precise gravity values, geoid values - GRAGEOID17 and KSA-GEOID17, Global Geopotential Models (GGM) geoid values for most recent Earth GGMs for TGBM-S for every TG, Dynamic Ocean Topography/Sea Surface Topography (DOT/SST) values for TGBM-S from the most recent models, DOT/SST values for TGBM-S based on analysis of ~34 years all available Satellite Altimetry Missions for Red Sea and Arabian Gulf, ellipsoidal heights for main TGBMs, CORS ellipsoidal height time series, gravity data coverage around TGs from airborne gravity) with the great advantage that they are collocated at the TGs, but themselves referred to different reference systems and leading to its complex nature. It was a great challenge for him to combine them and to find the adequate solution developing a concept and corresponding methodology using advanced methods and models. He defined a new multi-vertical datum problem (m-VDP) and proposed three strategies for the

solution. Analyzing them he proposed the Strategy 3C for combination of all data and strategies utilizing GBVP, GNSS/Leveling and Oceanographic approaches. The important result from the solution of m-VDP over the territory of KSA is the obtained average shift w.r.t. to KSA-VRF14 of -0.067 m and a slope from Red Sea to Arabian Gulf of -0.040 m. An important conclusion of Eng. Othman Al-Kherayef is that he considered the contributions of his thesis research in their future geodetic application in transition: from static to dynamic/changing in time Vertical Reference Frames&Vertical Datum, from precise to very high accurate Vertical Reference Frames&Vertical Datum, from local/national to regional/global coverage of Vertical Reference Frames&Vertical Datum, from nation/regional Vertical Reference Frames&Vertical Datum to a unified International Reference Height System (IRHS) and an improved KSA-VRF based on new KSA-GEOID20 as an important realization of IRHS.

Othman Al-Kherayef presented all the necessary documents and materials in his dissertation that meet the legal requirements of the Republic of Bulgaria, as well as the Rules on the Conditions and Procedures for Acquiring Educational and Scientific Degrees and Occupation of Academic Positions in Mining and Geology University "St. Ivan Rilski".

The dissertation has a volume of 211 pages, including 90 figures and 21 tables, divided into 6 chapters, 78 references, 3 appendices and definitions. The Chapter I reviews problem of the combination of different types of earth geodetic observations for determination of the Vertical Datum and the Vertical Reference Systems globally and specifically in the SA. On this basis, the aims and the main objectives of the dissertation are well-grounded defined. The Chapter II presents the geodetic foundations needed to solve the defined aims and tasks, and Chapter III presents the analysis, comparison and interpretation of various contemporary methods for solving the problem, and specifically for SA. A multi vertical datum problem (m-VDP) is defined and different approaches for its solution are proposed. Chapter IV presents the available data, information and the national geodetic infrastructure of the SA. Chapter V analyzes and generalizes the results of the experiments performed, and Chapter VI presents generalized conclusions, recommendations, and contributions. At the end of each chapter, a generalization from the analysis performed is also made.

The Extended summary consists of 53 pages and reflects adequately the content and contributions of the dissertation.

Four co-authored papers related to the theme of the dissertation were presented as Eng. Othman Al-Kherayef being the first author.

No citations are given.

I would like to make the following key critical notes without affecting the results obtained:

- The well-known geodetic foundations needed to solve the problem in Chapter II are presented in too much detail and are rather structured as a textbook. It would be better to be generalized and shortened.

- The main contributions presented in the List of contributions are 12 and in the Extended Summary and in the Thesis they are presented as detail contributions of 3 basic contributions as different numbering style is used. It should be used and applied the same numbering structure.

- It would be better to be generalized some of the contributions and to be reduced their total number.

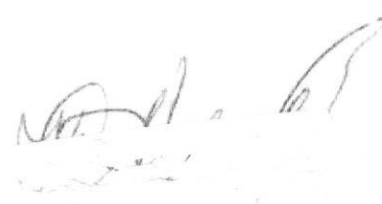
- The numbering structure of the entire thesis is very mixed – letters and numbers are used (A, . . . ,1.1., . . . , i, . . . , etc.), which makes the reading and comparisons more difficult. More appropriate is to be applied the same numbering structure.

CONCLUSION: The dissertation submitted to me for a statement is a competent, exhaustive and complex scientific and applied study of actual problems in an important area. The wide professional experience of Eng. Othman Al-Kherayef has reflected in the achieved positive results, the generalizations and contributions made in science and practice, which are of particular national importance for SA.

Based on the above mentioned achievements of the presented dissertation and results, as well as the scientific and the applied contributions, I give a positive assessment of the dissertation and recommend to the Honorable Scientific Jury to award the educational and scientific degree "Doctor" to Eng. Othman Al -Kherayef at MGU "St. Ivan Rilski", professional field " Architecture, Construction and Geodesy ", specialty "Surveying, Geodesy and Applied Geodesy ".

02/28/2020

Author of statement:



Sofia

/Prof. Dr. Eng. Keranka Vassileva/

ЗАПИЗЕНИ ДАНИИ СЪГЛАСНО
Чл. 2 от ЗЗПД