

**INTERNATIONAL SUMMER SCHOOL IN THE
MOUNTAINS MATHEMATICAL METHODS IN
PHYSICAL GEODESY
RAMSAU, AUSTRIA, 20–30 AUGUST, 1973**

REPORT BY H. MORITZ
Technische Hochschule, GRAZ

This meeting was organized by the Geodesy Department of the Technical University at Graz in cooperation with the IAG Special Study Group N^o.4.31, "Mathematical Methods in Physical Geodesy". Its purpose was to introduce interested scientists to advanced mathematical methods and to provide a forum for discussion for members of SSG 4.31. It was attended by 45 participants from 13 countries.

In an Introductory Lecture, K. Rinner (Graz) provided a general frame by placing the topic of the meeting within the context of geodesy, geodynamics and environmental sciences. H. Moritz (Graz) gave a general introduction to mathematical methods in physical geodesy.

A series of four lectures on functional analysis by P. Meissl (Graz) introduced geodesists to an advanced mathematical technique which has become the basic tool for theoretical progress in physical geodesy during the last years, both in Molodensky's theory and in collocation. Tensor calculus, nowadays a standard technique, was presented by its pioneer in geodesy, A. Marussi (Trieste). A. Bjerhammar (Stockholm) introduced his theory of generalized inverses of arbitrary matrices; this theory has recently found wide application even outside geodesy, especially in statistics.

Two main applications of these mathematical tools were particularly emphasized at the summer school: collocation and Molodensky's problem. Collocation is an advanced least-squares technique that generalizes adjustment and prediction techniques into a unified theory of estimating both geometric parameters and the gravity field of the earth. Here the anomalous gravitational field is treated on a statistical basis, together with the measuring errors.

An elementary introduction into collocation was given by H. Moritz. E. Grafarend (Bonn) gave a detailed presentation of the statistical treatment of the anomalous gravitational field as a stochastic process. T. Krarup (Copenhagen) presented "Integrated Geodesy" as a general method for determining the geometry

and the gravity field of the earth by collocation. C.C. Tscherning (Copenhagen) treated collocation using the theory of Hilbert spaces with a kernel function and outlined applications to determinations of the geoid. K.P. Schwarz (Graz) presented an application of collocation to the determination of zonal harmonics from satellite observations. A. Bjerhammar reviewed and compared different methods of estimation in physical geodesy, using the theory of generalized inverses as a unifying concept.

The elements of Molodensky's theory were presented by H. Moritz. E. Grafarend discussed it from the general point of view of free boundary-value problems and in relation to a differential-geometric treatment of the gravity field in terms of Cartan frames. T. Krarup presented a new approach to potential theory as a theoretical background for Molodensky's problem and for collocation.

The program was rounded by two lectures on problems of mathematical statistics by G.S. Watson (Princeton University) and by seminars on collocation (chairman I.I. Mueller, Ohio State University), on differential geodesy (chairman A. Marussi) and on Molodensky's problem (chairman P. Meissl).

