**Discussion**

Bjerhammar: Has the convergence of series been investigated?
Yeremeyev: In my solution, there are no series employed.

Bjerhammar: We start from non-linear integral equations. The first step — the transition to linear integral equations — means a simplification of the problem, but the question is, how much is neglected from the given series. In the year 1962, a critic of the western school was published. It criticizes my statement that it is impossible to form a linear integral equation without a certain simplification (neglection of the slope of the Earth's surface). I insist on this statement. Any linear integral equation solving a given problem represents only an approximation of a solution. The basic difference between our schools lies in the fact that the Soviet school does not consider the Earth's surface as unknown. When we speak about a non-linear integral equation, we admit that we do not know the Earth's surface.

Makarov: The surface of the first approximation is known. It is the surface which is distant from the reference ellipsoid by the normal heights.

Tengström: It should be tested in test areas whether Molodensky's series really converge even for great terrain slope. We have some experience of magnetism where we compute the distribution of magnetisation. In certain cases the series converge, in others they do not. I should like to refer once more to the paper of Dr. Pellinen. When computing the mean anomalies it is necessary to deal with the choice of the reduction and it is essential to determine statistically the dependance of anomalies on topographic masses.

**SOME PROBLEMS REGARDING THE WAY OF SOLVING MOLODENSKY'S INTEGRAL EQUATION FOR THE EARTH CONSIDERED AS A PLANE**

MARIN TIRON, CONSTANTIN STRUTU

*Bucharest*)

In 1945 [1], Molodensky demonstrated that geodetic measurements carried out on the physical surface of the Earth may be reduced to the reference ellipsoid, avoiding the Listing geoid, which cannot be rigorously determined. The problem raised by Molodensky led him to the substantiation of the theory of the physical surface of the Earth. This theory has a more general character than the theory formulated by Stokes in 1849.

In flat regions, where the heights of the points on the physical surface are small, Stokes' theory is satisfactory, but this is not so when the triangulation nets cross mountain masses. In this latter case, as it is shown in [4], the calculation errors can exceed the errors of the geodetic measurements, because of the extrapolation of the potential and of its gradient in the area between the geoid and the physical surface, where the variation of the density of masses is unknown. In order to avoid this difficulty, both the potential and its gradient are considered as given on the surface.

*) Address: Bulevardul Dinicu Golescu 19, Raionul 16 februarie, Bucureşti, Roumania.
on which they have been measured, i.e. directly on the physical surface of the Earth. Each other surface which is introduced leads either to useless complications, or to inadmissible simplifications, which do not correspond to the real conditions. In our opinion, this is where Molodensky's theory is superior to all those proposed previously, Stokes' theory included.

The purpose of this work is not to emphasize the superiority of Molodensky's theory, which is generally known, but to establish relations which permit an approximation as accurate as possible of the fundamental integral equation in the near vicinity of the studied point, and also to give the formulas necessary for the construction of the calculating templates.

In Molodensky's theory the potential disturbance is defined by means of the following relation:

\[ T = \int_{(S)} \phi r^{-1} \, dS. \]

The auxiliary function \( \phi \) which represents the density of masses of a single layer at the physical surface of the Earth, is obtained by solving the following integral equation:

\[ 2\pi \varphi \cos \alpha = (g - \gamma) + \frac{1}{2} q_0^{-1} \int_{(S)} \left[ r^2 + \frac{1}{4}(q^2 - q_0^2) \right] r^{-3} \varphi \, dS, \]

where \( (g - \gamma) \) = the gravitational free air anomaly determined on the physical surface of the Earth; \( q_0 \) = the radius vector of the investigated point \( M_0 \) relating to the centre of the Earth; \( q \) = the radius vector of the variable point \( M \) relating to the centre of the Earth; \( r \) = the distance between the investigated point and the variable one; \( \alpha \) = the slope angle of the surface \( S \) (Fig. 1).

The integral in Eq. (2) is to be solved either directly, for the auxiliary function \( \varphi \), or by substituing

\[ 2\pi \varphi = \mu \cos \alpha. \]

By introducing relation (3) into (2), we obtain

\[ \mu = \bar{\mu} + \mu_z, \]

where

\[ \bar{\mu} = (g - \gamma) + \frac{1}{2} (\pi q_0)^{-1} \int_{(S)} k(r, \Delta H) \bar{\mu} \, d\sigma, \quad \mu_z = \bar{\mu} \tan^2 \alpha, \]

\[ d\sigma = dS \cos \alpha, \quad k(r, \Delta H) = \left[ r^2 + \frac{1}{4} \Delta H (2q_0 + \Delta H) \right] r^{-3}. \]