

$$x = x', \quad y = y' \sin \varphi + z' \cos \varphi, \quad z = -y' \cos \varphi + z' \sin \varphi$$

leads to the system

$$\begin{aligned} u'_t - 2\omega v' - v\Delta u' + Q_{x'} &= F'_1, \\ v'_t + 2\omega u' - v\Delta v' + Q_{y'} &= F'_2, \\ w'_t - v\Delta w' + Q_{z'} &= F'_3, \\ u'_{x'} + v'_{y'} + w'_{z'} &= 0. \end{aligned} \tag{14}$$

Excluding velocity components we have

$$\left[\left(\frac{\partial}{\partial t} - v\Delta_1 \right)^2 \Delta_1 + 4\omega^2 \frac{\partial^2}{\partial z'^2} \right] Q = -F^{(Q)}. \tag{15}$$

Assuming in dimensionless values that v is small, we seek a solution in the form

$$Q = q_0 + vq_1 + v^2q_2 + \dots, \tag{16}$$

which gives the recurrent system

$$\begin{aligned} \left(\frac{\partial^2}{\partial t^2} \Delta_1 + 4\omega^2 \frac{\partial^2}{\partial z'^2} \right) q_0 &= F^{(Q)}, \\ \left(\quad \quad \quad \right) q_1 &= 2 \frac{\partial}{\partial t} \Delta^2 q_0, \\ \left(\quad \quad \quad \right) q_2 &= 2 \frac{\partial}{\partial t} \Delta^2 q_1 - \Delta^3 q_0, \\ \left(\quad \quad \quad \right) q_3 &= 2 \frac{\partial}{\partial t} \Delta^2 q_2 - \Delta^3 q_1, \\ \dots \dots \dots \\ \left(\quad \quad \quad \right) q_{n+1} &= 2 \frac{\partial}{\partial t} \Delta^3 q_n - \Delta^3 q_{n-1}. \end{aligned} \tag{17}$$

We have solved these equations in the preceding section.

THE SOLUTION IN A SPHERICAL COORDINATE SYSTEM UNDER LOCAL CONDITIONS

In an immobile system of Cartesian coordinates with the coordinate origin at the center of the earth with the z-axis directed northward along the earth's axis, the motion equations have the form

$$\begin{aligned} \frac{du}{dt} &= -\frac{1}{\rho} \frac{\partial p}{\partial x} - \frac{\partial \Phi}{\partial x}, \\ \frac{dv}{dt} &= -\frac{1}{\rho} \frac{\partial p}{\partial y} - \frac{\partial \Phi}{\partial y}, \\ \frac{dw}{dt} &= -\frac{1}{\rho} \frac{\partial p}{\partial z} - \frac{\partial \Phi}{\partial z}. \end{aligned} \tag{18}$$

It is easy to obtain a system of motion equations in the same coordinates as before, but confined to the earth

$$\begin{aligned} \frac{du'}{dt} + 2\omega v' &= -\frac{1}{\rho} \frac{\partial p}{\partial x_1} - \frac{\partial}{\partial x_1} \left(\Phi - \omega^2 \frac{x_1^2 + y_1^2}{2} \right), \\ \frac{dv'}{dt} - 2\omega u' &= -\frac{1}{\rho} \frac{\partial p}{\partial y_1} - \frac{\partial}{\partial y_1} \left(\Phi - \omega^2 \frac{x_1^2 + y_1^2}{2} \right), \\ \frac{dw'}{dt} &= -\frac{1}{\rho} \frac{\partial p}{\partial z_1} - \frac{\partial}{\partial z_1} \left(\Phi - \omega^2 \frac{x_1^2 + y_1^2}{2} \right), \end{aligned} \tag{19}$$