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

leads to the system

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

Excluding velocity components we have

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

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

$$Q = q_0 + \nu q_1 + \nu^2 q_2 + \dots, \tag{16}$$

which gives the recurrent system

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

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

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