



The recovery of Earth gravity field from GOCE data based on the invariants of the gravity gradients

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Abstract: By introducing the invariants of the gravity gradients, some boundary conditions on GOCE satellite orbit can be established. Therefore, the gravity field can be restored from GOCE data by solving the boundary value problems. This means that it can be avoided to solve a large number of linear systems of equations. Because of the fault of gradiometer in GOCE mission, the gravity gradients from GOCE contain much low frequency error, thus it is necessary to filter the error.

The following works are done in our research. Firstly, some filter operations are applied to the gravity gradients from GOCE. In this paper, we adopt method of forward-backward filtering in order to solve phase drift problem. Secondly, the invariants of the gravity gradients are computed, so the boundary value problems are proposed. The related mathematic models are

$$\begin{cases} \text{Lap}T = 0 \\ \left. \frac{\partial^2 T}{\partial r^2} \right|_S = -\frac{r^3}{3} \Delta B \\ T = O(r^{-1}), \quad \text{at } \textit{infinity} \end{cases}$$

and

$$\begin{cases} \text{Lap}T = 0 \\ \left. \frac{\partial^2 T}{\partial r^2} \right|_S = -\frac{r^6}{3} \Delta C \\ T = O(r^{-1}), \quad \text{at } \textit{infinity} \end{cases}$$

where T is disturbance potential and ΔB and ΔC are disturbance of the invariants B and C. Finally, a model of the gravity field can be obtained from solving the boundary value problems. In addition, the analyses about the accuracy of the model are also discussed.

Keywords: GOCE, Filtering, Invariants of the gravity gradients.