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A Brovar type solution of the fixed geodetic boundary value problem

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For more than 150 years gravity anomalies have been used for the determination of geoidal heights, height anomalies and the external gravity field. Due to the fact that precise ellipsoidal heights could not be observed directly, traditionally a free geodetic boundary value problem (GBVP) had to be formulated which after linearisation is related to gravity anomalies. Since nowadays the three-dimensional positions of gravity points can be determined by GNSS very precisely, the modern formulation of the GBVP can be based on gravity disturbances which are related to a so-called fixed GBVP using the topographical surface of the Earth as boundary surface.

The paper discusses various approaches into the solution of the fixed GBVP which after linearization corresponds to an oblique-derivative boundary value problem for the Laplace equation. Among the analytical solution approaches a Brovar type solution is worked out in detail, showing many similarities with respect to the classical solution of the scalar free GBVP.