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# A Hybrid PCG- Bat Algorithm for 2D Gravity Inversion: Applications for Ore Deposits Exploration and Interpretation of Sedimentary Basins

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Geophysical data such as gravity data can be inverted to get a subsurface image, which depicts the subsurface distribution of physical property. Consequently, inversion of geophysical data has an effective role for interpreting measured geophysical anomalies in hydrocarbons and mineral applications. Interest about ore deposits exploration and sedimentary basins interpretation is associated with their economic importance. The presence of sedimentary basins gives lower amplitude of gravity anomalies with negative signals, due to the negative density contrast as these sedimentary basins have lower density than that of the neighboring basement rocks. In prospecting ore deposits, studying the spatial distributions of densities in the subsurface is essential of significance.Two dimensional forward modelling strategy can be done via locating the rectangular cells with fixed size directly underneath the location of the observed data points using regular grid discretization. Density vector of the subsurface rectangular cells are obtained via solving the 2D gravity inverse problem by optimizing an objective function (i.e., the differences between observed and inverted residual gravity data sets). In this work, a hybrid algorithm merging a bat (BAT) algorithm with the preconditioned conjugate gradient (PCG) method is suggested as a mean for inverting surface gravity anomalies to obtain the density distribution in the subsurface. Like the hybrid, minimization algorithm has the capability to make use of the advantages of both two techniques. In this hybrid algorithm, the BAT algorithm was utilized to construct an initial solution for the PCG technique. The BAT optimizer acts as a rapid build-up of the model, whereas the second modifies the finer model approximated solution. This modern algorithm was firstly applied on a free-noise synthetic data and to a noisy data with three different levels of random noise, and good results obtained through the inversion. The validity and applicability of our algorithm are applied to real residual gravity anomalies across the San Jacinto graben in southern California, USA, and Sierra Mayor - Sierra Pinta graben, USA and prospecting of the Poshi Cu-Ni deposits, Xinjiang, northwest China. The obtained results are in excellent accordance with those produced by researchers in the published literature.

**Keywords:** Gravity data, 2D Inversion, BAT algorithm, Preconditioned Conjugate Gradient, Sedimentary Basins.