Optimization Problems in Space Geodesy

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In all the computations carried out in Space Geodesy, geodesists are confronted with optimization problems. These latter can roughly be classified in three categories :\\
- Combinatorial problems such as subset problems (search of an instrument sub-network optimizing a given criterion or of an optimal co-location site sub-network), classification problems (division of a global dense GNSS antenna network into several well distributed sub-networks to optimize the computation time), or even minimum cardinal subset problems (optimal selection of basis functions such as wavelets, to represent the Earth's gravity field).\\
- General problems without constraint such as the search for the optimal position, on the Earth's surface, of a new observation instrument.\\
- General problems with constraints such as the determination of optimal weights of heterogeneous data sets in a data processing, or even the computation of satellites orbits.\\

The large amount of data that requires to be processed, together with the possible ill-posed nature of some problems, do not allow us applying classical and/or deterministic approaches. We thus aim to solve all these problems on the basis of stochastic algorithms (possibly hybridized with deterministic methods), such as genetic algorithms.\\

This paper first aims at briefly describing some of the problems summarily listed above, regarding each of the three categories. Then, we summarize the principle and advantages of the genetic algorithms that have been chosen to solve some of the problems. Finally, the design of the algorithm applied and the results obtained are explained for some particular combinatorial problems.

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