



## Optimal Design of Geodetic Network Using Genetic Algorithms

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A geodetic network is a network which is measured exactly by techniques of terrestrial surveying based on measurement of angles and distances and can control stability of dams, towers and their around lands and can monitor deformation of surfaces. The main goals of an optimal geodetic network design process include finding proper location of control station (First order Design) as well as proper weight of observations (second order observation) in a way that satisfy all the criteria considered for quality of the network with itself is evaluated by the network's accuracy, reliability (internal and external), sensitivity and cost. The first-order design problem, can be dealt with as a numeric optimization problem. In this designing finding unknown coordinates of network stations is an important issue. For finding these unknown values, network geodetic observations that are angle and distance measurements must be entered in an adjustment method. In this regard, using inverse problem algorithms is needed. Inverse problem algorithms are methods to find optimal solutions for given problems and include classical and evolutionary computations. The classical approaches are analytical methods and are useful in finding the optimum solution of a continuous and differentiable function. Least squares (LS) method is one of the classical techniques that derive estimates for stochastic variables and their distribution parameters from observed samples. The evolutionary algorithms are adaptive procedures of optimization and search that find solutions to problems inspired by the mechanisms of natural evolution. These methods generate new points in the search space by applying operators to current points and statistically moving toward more optimal places in the search space. Genetic algorithm (GA) is an evolutionary algorithm considered in this paper. This algorithm starts with definition of initial population, and then the operators of selection, replication and variation are applied to obtain the solution of problem.

In this research, the first step is to design a geodetic network and do the observations of the distances and angles between network's stations. The second step is to use the optimization algorithms to estimate unknown values of stations' coordinates, with regards to calculation equations of length and angle. The result indicates that The Genetic algorithms have been successfully employed for solving inverse problems in engineering disciplines. And it seems that many complex problems can be better solved using genetic algorithms than those of using conventional methods.