The problem of mission design for a robotic servicing satellite in geosynchronous Earth orbit (GEO) was investigated. A representative set of potential client satellites was selected, and operational needs were randomly assigned based on the average number of GEO retirements, anomalies, and repositioning maneuvers that currently occur each year. An objective function was developed to represent the value of servicing mission sequences, including client fees, time penalties, and operational risk. A genetic algorithm was then used to find sequences of operations on the potential client set that maximized the objective function's value. Scenarios were analyzed with the database of satellites as well as with a dynamic client model. Sequences that begin with repair operations and later include refuel, observation, and retirement maneuvers were found to be the most valuable, with some differences in the optimal sequences depending on parameter values in the objective function.

Objective Function

$$C = \sum_{i=1}^{n} c_i \cdot \frac{V_i}{2 - \prod_{k=1}^{n} P_k} - c_2 \cdot b \cdot \max \left(0, T_i - T_{allow}\right)$$

where:
- \(b\) = Lost revenue per day of customer non-operation
- \(C\) = Total value of a chromosome
- \(c_{1}\rightarrow \) = Scaling factors for relative values of terms
- \(p\) = Probability of success for each servicing operation type
- \(s\) = Number of satellites in a mission sequence
- \(T\) = Time required for orbit transfer and servicing operation
- \(T_{allow}\) = Wait time allowed before customer starts deducting daily fee
- \(V\) = Revenue from servicer operation

Genetic Algorithm (GA) Structure

- **Populating**: Randomly populated
- **Fitness Testing**: Populated by fitness
- **Operating**: Mutation, Permutation, Crossover
- **Genetic Algorithm (GA)**: Objective function
- **Immigration**: Every generation
- **Stop criterion**: Stopping criteria reached

### 120 Day Time Allowance from Client Perspective

<table>
<thead>
<tr>
<th>Sequence No.</th>
<th>Longitude (°)</th>
<th>Time Penalty ($/day)</th>
<th>Operation</th>
<th>Operation Time (days)</th>
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### 120 Day Time Allowance from Servicer Perspective

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### Dynamic Client Model

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