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# OPTIMIZATION OF ENERGY COST FOR HORMOZ WASTEWATER PUMP STATION BY ANT COLONY ALGORITHM AND COMPARE BY GENETIC ALGORITHM

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## ABSTRACT

Operating this according to external conditions have changed. For example, in a different time or different months of the year and when rain will change the input. That consequently the pumping function must also be replaced. Duty station is transferred to the treatment plant. Direct discharge of waste water treatment of the environment has prevented And instead of sewage treatment plant effluent discharged to the environment.

The storage capacity of pumping stations can be used to optimize the amount of energy used station. The pumps normally-off approach to the operation of the pumps used. The traditional method can result in wasted energy. In this study, after proper pump selection Using optimization methods and genetic ant algorithm to optimize the performance of the pump is provided And compared together. Finally, after calculating the operating table in two ways ant colony and genetic algorithms found The ant colony algorithm to achieve the result is more acceptable and more efficient.

**Keywords: Genetic algorithms, ant colony optimization pumping station, Hormoz Island**

## 1. INTRODUCTION

Sewer systems are network. That domestic sewage and rainwater from the city collects And by pumping or gravity to move outside the city or their treatment. Based on the location of choice to build a pumping station to transfer sewage treatment plants

are designed. The station according to their working hours are consumed a lot of energy (Moradi *et al*., 2003). Optimization of pumping energy has always been one of the most important economic savings to be remembered. Pumping energy consumption amounts to about 22% of the total consumption of electric motors in the world.

And in particular in industrial applications for over 50% of the energy pumped. One of the main reasons for saving energy, reducing greenhouse gas emissions. As well as reducing the consumption of fuel sources and reduce the cost of energy production is also (Jaston, 2011). In this study, ant colony optimization and genetic algorithms for proper operation of pumping station capacity is used. For this purpose, the hourly consumption pattern and rate of waste production In order to provide the optimal performance of Hormuz island will be used for sewage pumping stations, So that with the lowest power consumption, best pumping occurs. The produced wastewater in 24 hours as the time of entry will be considered optimization models.

Constraints include the size of the storage tank, pumping station, pumping capacity and flow rate of the city's wastewater treatment plant Finally, the output of the optimizer can be seen by the pump. Due to cost a lot of energy to be spent on the

islands Reduce the amount of energy can be a good economic and social impacts.

## MATERIALS AND METHODS

### 2.1. **Ant colony algorithm:**

ant colony algorithm is inspired by the studies and observations on ant colony. These studies have shown that ants are social insects that live in colonies And their behavior in order to survive Clooney To promote the survival of a component of one of the most important and interesting behavior of ants, their behavior is to find food. And especially how to find the shortest path between a food source and nest this type of ant has a mass of intelligence. Has recently attracted the attention of scientists. In the real world randomly from side to side to go to find food. Then come to nest on the trail of pheromones (Pheromone), principally. Such traces are visible after the rain white. When this path find other ants, sometimes roam the left and follow it. Then, if the food they are home and refused to leave other traces of his side; In other words, the way to reinforcing. This method also can be used to solve problems on the basis of numerical possibilities And finding the best solution to a problem can be used.

### 2.2.Genetic algorithms:

Acronyms symbol GA search techniques in computer science to find approximate solutions to optimization and search

problems. GA is a special kind of evolutionary algorithms evolutionary biology such as inheritance and mutation of the techniques used. The algorithm was first introduced by John Holland. In fact, Darwin's natural selection principles of genetic algorithms to find the optimal formula to predict or use pattern matching. Genetic algorithms are often a good option for forecasting techniques based on Regression

**The study area**

Sewage pumping stations need to check to check the status of area, population and water demand due to population growth and the need for the city to discharge water at different conditions to obtain the station.

**3.1. Supply of Hormuz**

Now the water in the freshwater now Hormuz Island Hormuz will be provided. Freshwater capacity of 1,500 cubic meters per day, which is now the island's current needs.

**3.2. Era Pumping Stations**

Wastewater collection network design plan for the period of 20 to 30 year plan period are considered for electrical equipment And mechanically, Sewage should be extended to the maximum of their useful life is taken into account. For the design of wastewater treatment plants and pumping stations usually 10 to 20 year plan period chosen.

**3.3. Calculation of the input table Hourly**

To calculate the pump will first need to calculate the input flow. Since them easuring station for not accepting input .The theory used to calculate theinput table.

To calculate per capita and population growth rates during the period, assuming a uniform plan. Calculated by interpolate results for1394 are shown in Table1.

In this section were view the current status ofthe pumping station will be discussed Anditis calculated electricity consumption by pumps. It has 3 pump is pumping stations That they are working two and a pump is replaced. View pump station is shownin Table 2.

Station storage tank volume is 80 cubic meters and15 cubic meters and should always remainin the tank. The pump should work in such a way that the volume of waste water remains in the tank 80 does not exceed15cubic meters and to reduce the size ofthe pumps are off.

It was found that the station 17 hours a day is bright And according to the power consumption of each pump as much as 18 kw A total amount of 306 kilowatt hours of electricity consumed is sent.

**Table 1: Population, per capita waste water the study area**

| 1414 | 1394 | 1389 | Year |
|------|------|------|------|
| 14400 | 8480 | 7000 | Population(persons) |
| 239 | 195 | 183 | Per capitaproductionof waste(L.d.p) |
| 73 | 55 | 50 | Per capitalosses(L.d.p) |
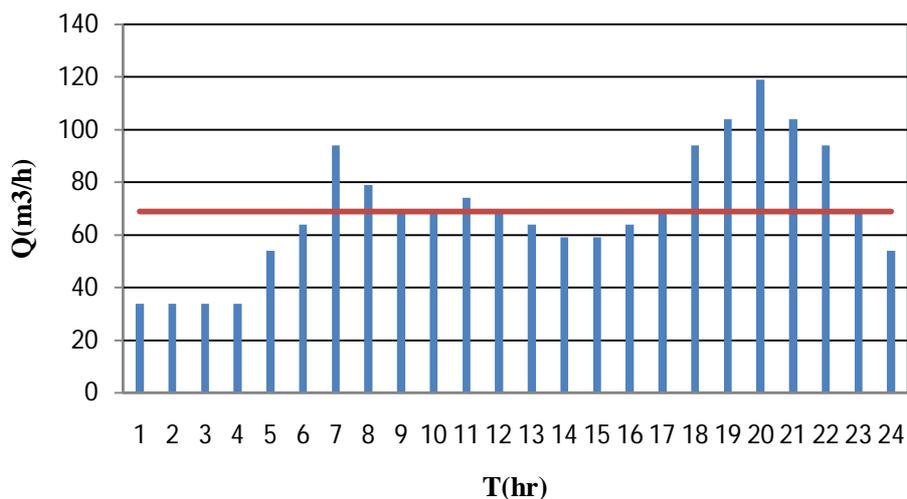
**Figure 1: The input of sewage pumping stations**

**Table 2: Profile pumps installed**

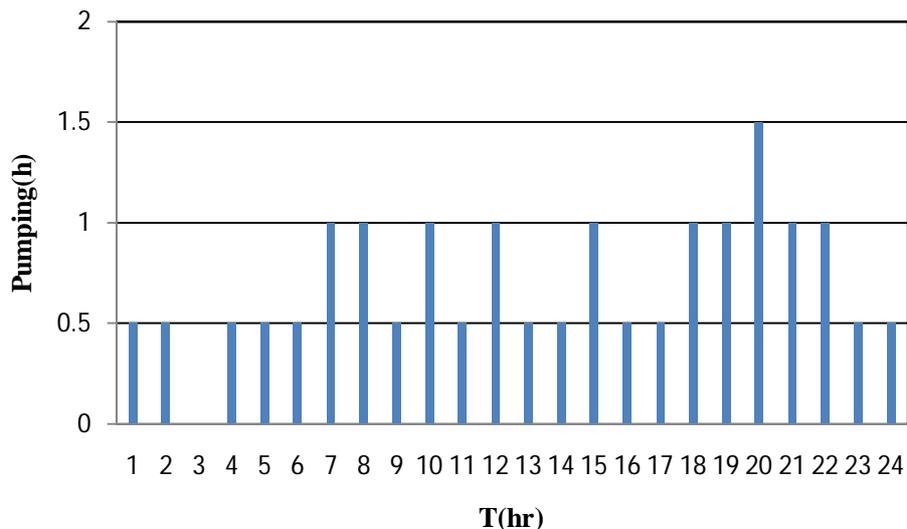| $Q_{max}$ (m$^3$/h) | 162 |
|---|---|
| H(m) | 40 |
| rpm | 1460 |
| Efficiency(%) | 60 |
| P(kw) | 30 |



**Figure 2: Diagram of the operation of pumps**

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**. RESULTS**

4.1. Calculation function table by using ant colony optimization algorithm
To start the first table of catalog Pumps submersible pumps Pump . mined Iran. The pump is fixed on the head required to pump sewage from the bottom to the transmission system are taken into account. The floor height from the surface and pump flow in constant head of 11 meters. Modeled after the optimal solution is to run 245 times As is clear from Figure 4 (four jumps chart) model to find the optimal solution has to start from scratch. The

pump model number 01 as the best option is chosen with the 85 kilowatt-hour. Optional pump flow without switching the pump And always a base flow to the pumping plant. And to do so up to three pumps with a capacity of 36 cubic meters per hour is required.

## 4.2. Calculation function table by using genetic algorithm optimization

The pump and the discharge of sewage arrival time as input to the model is the model station Then by 200 chromosomes in 20 people and a maximum of 400 replication model is executed. As stated in previous articles The aim is to minimize the amount of kilowatt-hours of pumping stations.

After model run 400 times to reach the optimal solution And, as is clear from the graph of the amount of the original estimate of 180 kWh to the amount of 90.45 reached

in the end. In this model, the pump (12) as the best option is selected with 90.45 kilowatt-hour.

Pump flow without switching station is selected. And always a base flow to the pumping plant. And to do so in four pumps with a capacity of 25 cubic meters per hour is required.

## 4.3 Top options

Table 3 summarizes the results of these methods is considerable. According to the results of the ant colony is known. The method with the lowest consumption without disruption is the best option. It should be noted genetic algorithm is also acceptable solution in terms of consumption. But given the number of pumps with a pump ant algorithm is better than the initial cost. And can be selected as a Top nettle.
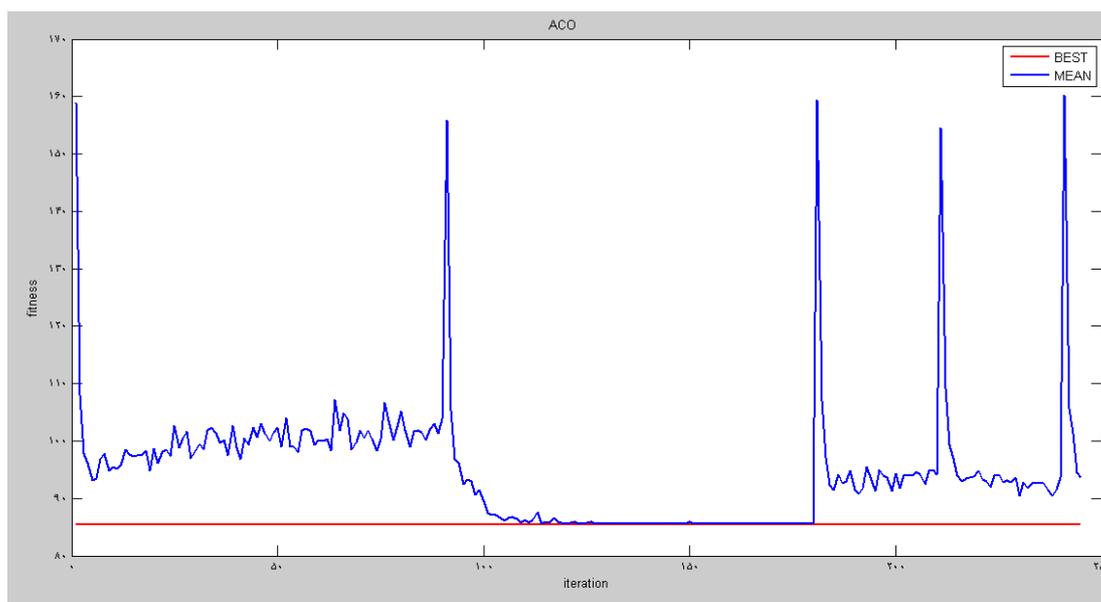


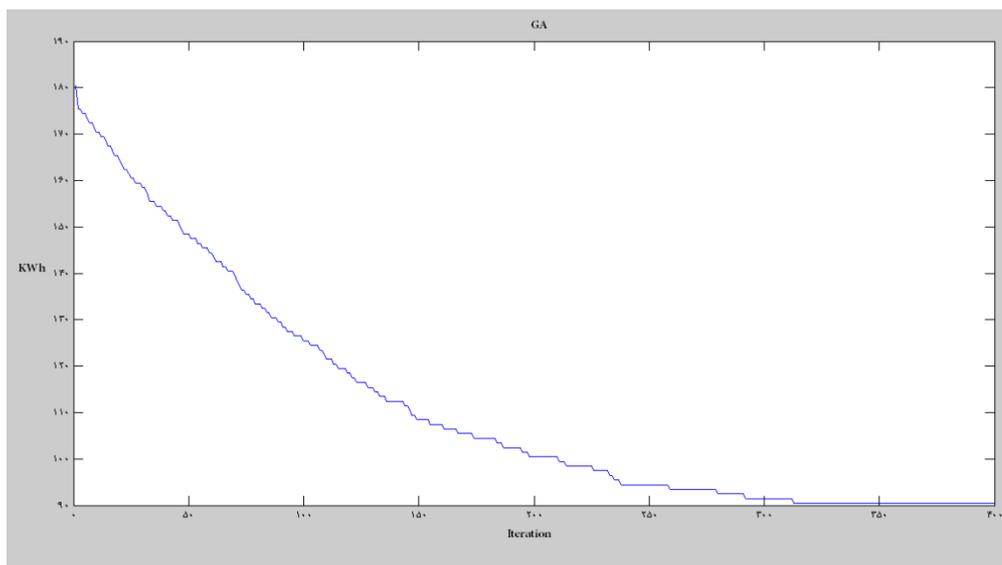**Figure 3: Diagram ant colony optimization algorithm model**

**Figure 4: Diagram of Genetic Algorithm optimization model**

**Table 3: Comparison of proposed**

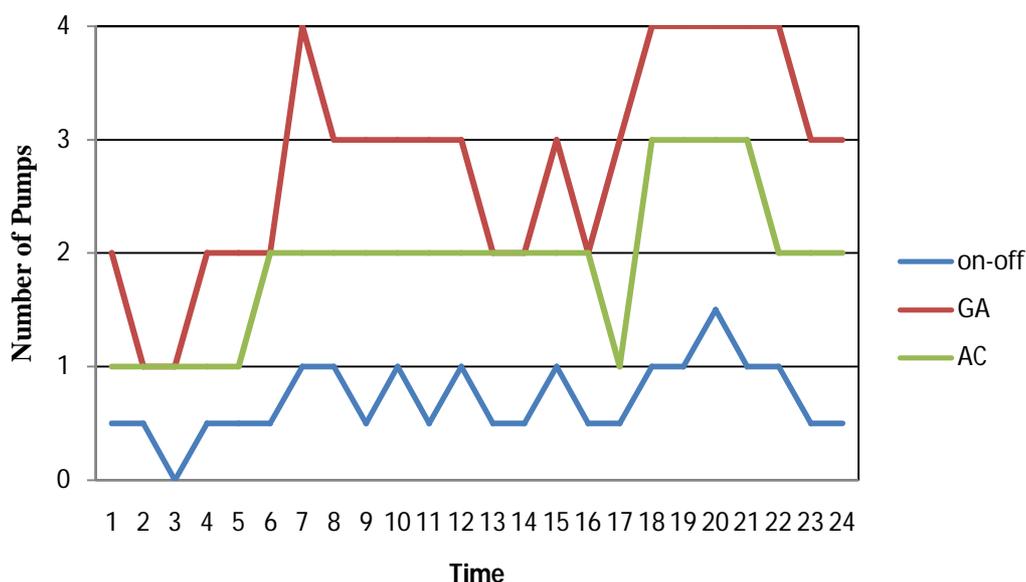| methods | FLOW(M3/h) | Power (kW) | function (h) | Consumption (kWh) | Cutoff (h) | the number of pumps |
|---|---|---|---|---|---|---|
| Ant Colony Optimization | 36 | 1.85 | 46 | 85 | 0 | 3 |
| GA | 25 | 1.35 | 67 | 90.45 | 0 | 4 |
| ON/Off method | 97 | 18 | 17 | 306 | 7.5 | 2 |



**Figure 5: How pumped are offered three ways**

## REFERENCES

1. Hashemi, S, Tabesh, M, Ataeekia, B, 2014, Ant-colony optimization of pumping schedule to minimize the energy cost using variable-speed pumps in water distribution networks, Urban Water Journal Volume 11, Issue 5, 91-105.

2. Ibáñez L, Prasad, T, Paechter, B, 2008 , Ant Colony Optimization for

Optimal Control of Pumps in Water Distribution Networks, Journal of Water Resources Planning and Management, Vol. 134, No. 4, 75-84.

3. Johnston, G, 2011, Minimizing Energy Consumption in a Water Distribution System, A System Modeling Approach, M.S Thesis of Texas A&M University.

4. Mitchell, M, 1996, An Introduction to Genetic Algorithms, MIT Press, Cambridge, MA.

5. Moradi-Jalal, M, Marino, M. A, Afshar, A, 2003, Optimal design and operation of rrigation pumping station. Journal of Irrigation and Drainage Engineering, 129(3), 149-154.