

Nature Inspired Computing

Assignment-3

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Reservoir Design Optimization using NSGA-II

Youtube Link: <https://youtu.be/Yt9ZJAepT2g>

Here, since the **total cost** is directly proportional to the total surface area of the reservoir, the objective function to be **minimised** is chosen as the **total surface area** and the objective function to be **maximised** is the **total volume** of the reservoir.

Function to minimise => Surface area: Sum of lateral surface areas of the hemisphere, cylinder and cone.

$$SA = \pi * r * (2*r + 2*h + \text{sqrt} (r*r + (h*h)/9))$$

Function to maximise => Volume: Sum of volumes of the hemisphere, cylinder and cone.

$$Vol = \pi * r * r * (2/3 * r + h + h/9)$$

RESULTS

After 50 iterations, The **extreme designs** on the final Pareto front for the two objectives are:

- **Lowest**
 - Total Surface Area: 131.94 m²
 - Total Volume: 114.6 m³
- **Highest**
 - Total Surface Area: 1328.0 m²
 - Total Volume: 4271.72 m³
- The design I would choose finally is:

- Total Surface Area (proportional to **cost**) = 681.64 m^2 ,
 - Total Volume = 1450.96 m^3 ,
 - Height(h) = 12.6 m and the Radius(r) = 5.1 m.
- This is because the above choice stands in **between** when it comes to considering the trade-offs while minimising T.S.A and maximising Volume. This way, the reservoir will have a maximum volume with minimal total cost.