Using newton method of optimization

Science, Mathematics

Using Newton Method of Optimization

Consider the two equations

Given that the required volume V is 20m3 and side x is 4m and the cost of the vessel depends on the surface area. The problem is to minimize the surface area to reduce the cost of the vessel.

Write surface area S in terms of either h or b as follows: plug the values of volume and side in the volume equation to get an equation in terms of h and b and make h the subject. The resulting equation is . Insert the value of x and substitute for h in the surface area equation to obtain. Note that it is easier to substitute for h than b in the surface area equation. The surface area equation can also be written as.

To optimize S, differentiate it with respect to b to get. Again differentiate it to obtain. The Newton direction is

Let, then.

The iterations continue for resulting values of b until d equals zero. When the difference d gets to zero, all iterations ensuing it yield a constant value of b. The constant is the optimal solution. Denoting the subscript of b by k, the table below shows the iterations. The constant value of b has been obtained after three iterations.

Table 1

k

bk

0

1

1

1. 777971

2

1. 78881

3

1. 788854

4

1. 788854