**Optimization of Non Linear Problems**

Numerous business processes exhibit nonlinear behavior. For instance, the price of a stock option is a nonlinear function of the price of the underlying stock, just as the price of a bond is a nonlinear function of interest rates. The amount produced often results in a reduction in the marginal cost of production, and the quantity required for a good is typically a nonlinear function of the price. Numerous commercial applications have these nonlinear interactions as well as many others. Any optimization issue where the objective function or a constraint has at least one nonlinear factor is referred to as a nonlinear optimization problem.

Price elasticity, which occurs when the amount of a product that may be sold has an inverse connection to the price paid, may be experienced by a big producer. As a result, the price-demand curve for a typical good may appear nonlinear, with a sharp decline in price as demand rises. The goal function may also exhibit nonlinearities if the marginal cost of manufacturing an additional unit of a certain good fluctuates with production level. For instance, a learning-curve effect may lead the marginal cost to decline when output level is increased (more efficient production with more experience).

Consider a company price-demand curve, in real life the curve isn’t linear as mentioned above. If we want to maximize demand based on price, then it would be a nonlinear programming example.

Since it is a single variable constrained equation, for optimization of the problem we can use **Newton’s Raphson Method**. Where we use the first derivative and then find the solution for maximum price.

If we consider two variables, then it becomes a multi variable nonlinear equation than we can consider partial derivatives and use **Karush-Kuhn-Tucker** conditions to determine the optimal solution to the problem.

Although, the derivatives provide an optimal solution. These methods don’t give optimal solutions all the time. Also, the solutions which we get does not guarantee optimal solution all the time. In conclusion we can say that this might be one of the ways to calculate solutions for non linear problems but there are few conditions that are need to be met for us to solve a non linear equation.