Module 2: Optimization using Calculus

Learning Objectives

Optimization problems with continuous differentiable functions can be solved using the classical methods of optimization. These analytical methods employ differential calculus to locate the optimum points. The classical optimization techniques fail to have an application where the functions are not continuous and not differentiable, and this happens with many practical problems. However a study of these calculus based methods is a foundation for development of most of the numerical techniques presented in later modules.

In this module a brief introduction to stationary points is followed by a presentation of the necessary and sufficient conditions in locating the optimum solution of a single variable and two variable functions. Convexity and concavity of these functions are explained. Then the reader is introduced to the optimization of functions or single and multivariable functions (with and without equality constraints). A few examples are discussed for each type. An insight is also given to the Lagrangian function and Hessian matrix formulation. Finally we take a look at the Kuhn-Tucker conditions with examples.

This module will help the reader to know about

1. Stationary points as maxima, minima and points of inflection

2. Concavity and convexity of functions

3. Necessary and sufficient conditions for optimization for both single and multivariable functions

4. The Hessian matrix

5. Optimization of multivariable function with and without equality constraints

6. Kuhn-Tucker conditions