

## **Module 8: Advanced Topics in Optimization**

### **Learning Objectives**

In the previous modules, we discussed about almost all the major techniques used for optimization. This module gives a brief outline of some additional methods often used to solve some typical optimization problems.

The module starts with a description of piecewise linear approximation of non-linear functions which will help the reader to approach the nonlinear problems to split up into linear sub problems and solve it using the ordinary simplex method. This will be followed by a discussion of multi-objective optimization problems, in which two methods will be explained to deal the multiple objectives. The decomposition of larger problems into smaller ones is illustrated in multilevel optimization. A brief outline of direct and indirect search methods will be given next. The importance of evolutionary algorithms and steps involved will be elaborated with special emphasis on genetic algorithms. The applications of these methods in civil engineering will be outlined toward the end of this module.

At the end of the module the reader will be able to

1. Solve a nonlinear problem through its linear approximation
2. Solve a multi-objective problem through weighted and constrained methods
3. Acquire an idea about the various direct and indirect search methods
4. Understand evolutionary algorithms
5. Visualize advanced optimization applications in civil engineering