College: Engineering **Student's Name:** Fadhil Abbas Jasim
Dept.: Civil **Supervisor's Name:** Prof. Dr. Nabeel A. Jasim

Certificate: Master **Specialization:** Structure

Title:

Optimum Design of Plate Girder

Abstract:

This study concerns with using various optimization methods to design simply supported plate girders used in buildings which minimize the total weight and satisfy the safety requirements. The optimum design of such girders is conducted by using genetic algorithm, sequential quadratic programming, goal attainment and multilevel optimization methods. Also, the ability of the goal attainment method to solve the multi-objective optimization problems and the efficiency of the multilevel optimization method are examined in this study.

The objective function is considered as the volume function which represents the volume of flange plates, web plate, transverse stiffener plates, longitudinal stiffener plates, and end post stiffeners plates. The design variables are taken as the width and thickness of the flange, depth and thickness of the web, outstand and thickness of horizontal, vertical, and end post stiffeners, horizontal stiffeners spacing, and the spacing between the stiffeners of the anchor panel. The constraints are formulated in accordance with the provisions of the British Standard (BS 5950: 2000 -1), which include minimum thickness requirements, moment resistance, shear buckling, deflection, stiffeners stiffness, and end anchorage constraints. The optimization process is carried out by using Matlab software version 2015.

The results clearly indicated that the considered optimization methods are successfully and efficiently used for the optimum design of plate girder but the sequential quadratic programming method is easier in use and faster in finding the global minimum. The goal attainment method can successfully be used to minimize both single and multi-objective optimization problems but the results depend on the goal and weight vectors. The multilevel optimization method makes the process faster but choosing the problem of each level and the coordination variables is so important to find the right results. Also, the results show that the web depth should be increased as possible to decrease the flanges weight which represents more than 50% of the total weight. The vertical buckling of the compression flange controls the web depth-to-thickness ratio in the deep webs.