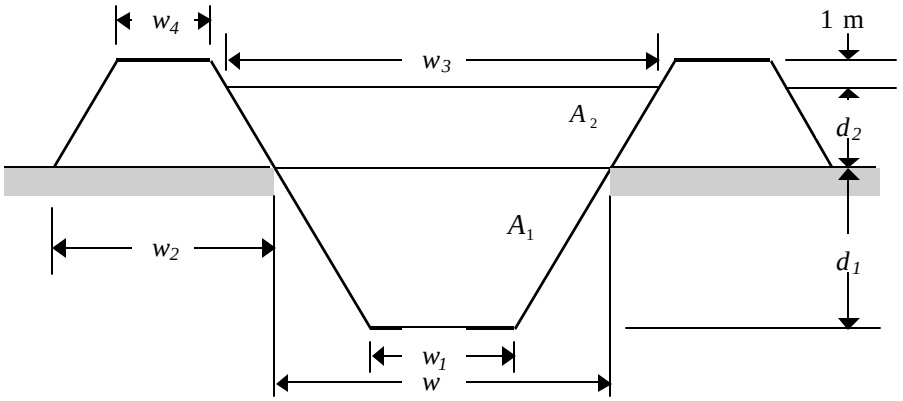
AOE/ESM 4084 - ENGINEERING DESIGN OPTIMIZATION
Fall Semester, 2000

Homework Assignment 4



Design of the water channel presented in HW # 1 is to be performed using Sequential Linear Programming (SLP). The objective is to minimize the excavated area, A_1, which is equal to the material used for the dykes. It is also required that the wet-section cross sectional area is at least 150.0 m^2. Also, the water depth in the canal, $d_1 + d_2$, must be larger than 15 m.

The requirement that the slope of the soil is constant along the sidewalls of the canal can be expressed in the following form,

$$\frac{w - w_1}{d_1} = \frac{w_2 - w_4}{1 + d_2}$$

which yields the following equation,

$$(w - w_1)(1 + d_2) - (w_2 - w_4)d_1 = 0 \qquad (1)$$

From the slope relation, the width of the top surface of the water, w_3, can also be computed,

$$\frac{w_3 - w_1}{d_1 + d_2} = \frac{w - w_1}{d_1}$$

which yields the following equation,

$$(w_3 - w_1)d_1 - (w - w_1)(d_1 + d_2) = 0 \qquad (2)$$

These two equations can be used to eliminate two of the variables from the problem, leaving us with only five independent variables. Although the remaining equality constraint may be used to solve for one more variable to reduce the number of

independent variables to four, this is not advisable since the equations may become complicated.

a) Use the Mathematica based SLP to solve the problem starting from at least three different initial points, and using two different settings for the move limits value, 30% and 60%, for each of the starting points, and two different move limit reduction factor, 10% and 30%, for each of the move limit values (for a total of 12 optimization runs). In each case, plot the progress of the value of the objective function, as well as the design variables as a function of the iteration number, and compare the results and explain the differences between the different runs.

   Due 2.00 PM, Tuesday, October 10.

b) Use SLP implementation in VisualDOC, and compare the results with the ones obtained in part a). Count the number of function and constraint evaluations, and compare them with the ones that you found in part a)

   Due 2.00 PM, Tuesday, October 17.