CHAPTER 4

CONCLUDING REMARKS

4.1 CONCLUSIONS

We investigated the truss sizing problem with material nonlinearity using the Displacement Based Optimization (DBO) approach. The holonomic (path-independent) elastoplastic laws were assumed so that linear elastic truss sizing in the DBO setting was naturally extended for our study. A computer program, facilitated by using industrial optimizer DOT (VR&D, 1999) and IMSL Linear Programming solver (Visual Numerics, Inc., 1997), was developed to study this type of problems. For comparison, we chose an important class of minimum truss weight design problems first proposed by Kaneko and Maier (1981), where holonomic linear strain hardening behavior was used. Short of published truss design examples for our purposes, we also created additional examples. For Limit Design problems, we could verify DBO optimum results by comparing to those solutions that are obtained via a Mathematica based Limit Design program.

All examples were tested successfully by using the DBO approach. Solutions of some examples were well consistent with other available results. Other examples such as an 128-bar truss were studied. A particular attention was given to computational time. The DBO showed to be very efficient. For the 128-bar example, computational effort was impressively small. Furthermore, results of both 10-bar and 128-bar examples proved that the DBO approach is well suited for truss topological design where a removal of truss members is necessary.

4.2 FUTURE PERSPECTIVES

From our experience of testing those examples in Chapter 3, we can state that sometimes DBO approach would experience more difficulties to get same results as those obtained from other approaches. Enhancement of the DBO procedures is definitely needed. As far as the author realizes, the following two techniques may be among the most important priorities to explore.

First is scaling of displacement design variables. For most cases, a slight change of displacement could substantially alter the structure. A dynamic scaling procedure would work better than the currently used scaling of constant bounds. Borrowed ideas from move limits strategy, scaling based on feasible region surrounding current displacement design point may help to amplify the most important displacements so that searching moves in a more efficient way.

Second is to modify the current relaxed form used in the inner level problem, which was suspected to result singular outer level problems. A smooth yet simple relaxation form would improve searching quality of DBO approach while still

eliminating the problem of infeasible displacement field, which may be generated by the outer level searching.