Detailed Simulation Data for the Best Solutions Found by Fully Stressed Design Evolution Strategy

This folder includes the MATLAB files to plot and analyze the reported solutions found by FSD-ES or FSD-ES-II in the corresponding publications [1,2,3]. Please mention the publication if you are using these data. To simulate the reported solution, simply run the m-file whose name, starting with 'confirm', includes the name of the problem. The simulation file is provided for the following problems:

277-bar bridge in scenarios I [1]
277-bar bridge in scenarios II [1]
277-bar bridge in scenarios III [1]
224-bar pyramid [1]
110-bar transmission tower [1]
77-bar bridge [1]
68-bar truss [1]
47-bar transmission tower (Topology, shape and size optimization) [1]
47-bar transmission tower (shape and size optimization) [3]
39-bar two-tier [3]

There is a notable point regarding the slenderness constraint when using AISC-ASD specifications. Since we recorded each feasible solution with 10-digit accuracy, it is possible that axial forces of the members change slightly. Most of the time this negligible difference is not observable; however, it may cause confusion when checking the slenderness constraint. The allowable slenderness has a jump at $\sigma=0$ (it is 200 for compression and 300 for tension). It is possible that a member axial force changes from a small positive value to a small negative value. This may show a slenderness constraint violation. This can be easily confirmed by checking the axial force of the members that violate the slenderness constraint, which must be a very small compared to the average axial forces of other members.

References

[1] A. Ahrari and K. Deb, "An improved fully stressed design evolution strategy for layout optimization of truss structures," Computers & Structures, vol. 164, pp. 127-144, 2016.

[2] A. Ahrari and A. A. Atai, "Fully stressed design evolution strategy for shape and size optimization of truss structures," Computers & Structures, vol. 123, pp. 58-67, 2013.

[3] A. Ahrari, A. A. Atai and K. Deb, "Simultaneous topology, shape and size optimization of truss structures by fully stressed design based on evolution strategy," Engineering Optimization, vol. 47, no. 8, pp. 1063-1084, 2015.