Comparison of TLBO, DE, and BBO Algorithms for Applications in Electromagnetics

Edwin E. Rebollo* and Sembiam R. Rengarajan
Department of Electrical and Computer Engineering
California State University of Northridge, CA 91330-8346
edwin.rebollo.126@my.csun.edu, srengarajan@csun.edu

The differential evolution (DE) algorithm is a well-established evolutionary algorithm (EA) that has been applied to many engineering design optimizations (R. Storn and K. Price, Journal of Global Optimization, 11, pp. 341-359, 1997). It is a powerful, population based, stochastic function minimizer. Another EA called the biogeography based optimization (BBO) algorithm is more recent and has been shown to have great potential (D. Simon, IEEE Trans. Evolutionary Computation, 12, pp. 702-713, 2008). It is based on the study of the geographical distribution of biological organisms. The teacher-learner based optimization (TLBO) algorithm is also fairly new and it is known for its potential engineering applications (R. V. Rao, V. J. Savsani, and D. P. Vakharia, Computer-Aided Design, 43, pp. 303-315, 2011). This method works on the effect of the influence of a teacher on learners. It uses a population of solutions to obtain a global optimum. The performance of these algorithms was tested using five mathematical test functions to ensure that the settings for each algorithm were at their best. The results for the five test functions were compared and evaluated. The ranking of the algorithms revealed by the data had the DE as 1st, TLBO as 2nd, and BBO as 3rd. The study of these algorithms helped identify each of their capabilities for future electromagnetic applications. A previous design of an antenna array power pattern using a genetic algorithm (GA) was tested using these three algorithms. BBO and TLBO were found to be about twice as fast as the GA for similar accuracy while DE was about 7 to 8 times faster than GA. The positive results from this study suggest that these algorithms should be further explored to expand and support other electromagnetic applications. Other applications of these algorithms will be presented in the conference.