generations, and for several population sizes we applied the LO to the best solution of each one of the 50 runs. The termination conditions for the local optimizer were that the MSE had a value smaller than 1.5201×10^{-3} and a variation between iterations smaller than 10^{-15}. Figure 3(b) shows the percentage of convergence successes in 50 trials taken by the local optimizer to converge. It is clear that for higher population sizes, even when the algorithm is switched at a higher MSE value (20 generations) the LO method is almost able to reach a desirable minimum. However, MOGA reaches the optimization minimum value for a lower population size with lower computational effort.

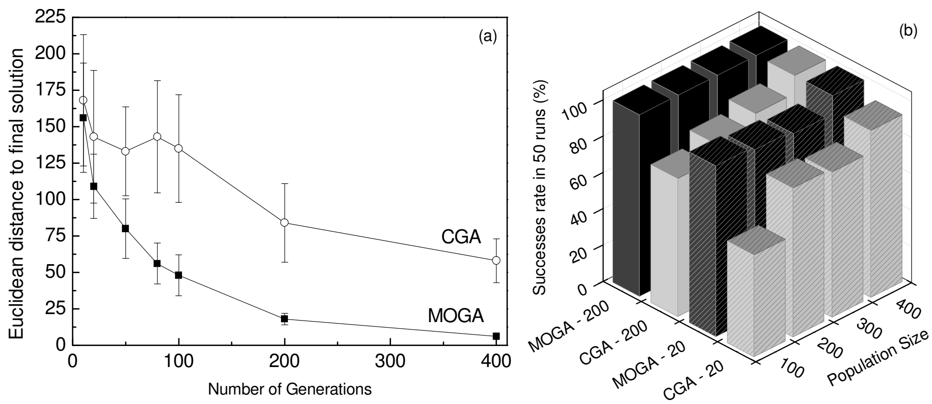

Fig. 3. (a) Euclidean distance to the final solution (50 runs and population of 400 elements) as function of the generation's number for CGA and MOGA algorithms (population size of 400 individuals). The lines are visual guides. (b) Convergence rate for 50 iterations as function of the population size for the two considered algorithms.

The results make clear that, even being GA's stochastic optimizers; there is a trend in it that indicates a better performance from multi objective than the one found in common genetic algorithms. The explorative capacity of GA's makes this type of optimization well suited to address problems with many variables and large search spaces.

The difference in performance of both algorithms could be explained regarding the non dominated solutions. The MOGA solutions that are simultaneously better for both samples are preferred to evolve, while the CGA ones with higher probability to evolve correspond to the better fitness for the sum of all solutions (independently of each individual fitness).

6. Conclusions

We have introduced for the first time the use of hybrid multi-objective optimization in spectroscopic ellipsometry data analysis. The procedure was validated, using planar waveguides of sol-gel derived organic-inorganic hybrids on oxidized silicon wafers. For the implementation of the hybrid optimization a single objective common genetic algorithm (CGA) was compared to a multi-objective genetic algorithm (MOGA), showing a higher success rate in the task of finding the best final solution for MOGA. Furthermore, we demonstrated that the hybrid MOGA is potentially faster than the CGA and also that its efficiency can be improved when the right moment to switch methods is properly chosen.

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