Solving a highly multimodal design optimization problem using the extended genetic algorithm GLEAM

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Abstract

In the area of micro system design the usage of simulation and optimization must precede the production of specimen or test batches due to the expensive and time consuming nature of the production process itself. In this paper we report on the design optimization of a *heterodyne receiver* which is a detection module for optical communication-systems. The collimating lens-system of the receiver is optimized with respect to the tolerances of the fabrication and assembly process as well as to the spherical aberrations of the lenses. It is shown that this is a highly multimodal problem which cannot be solved by traditional local hill climbing algorithms. For the applicability of more sophisticated search methods like our extended Genetic Algorithm GLEAM short runtimes for the simulation or a small amount of simulation runs is essential. Thus we tested a new approach, the so called *optimization foreruns*, the results of which are used for the initialization of the main optimization run. The promising results were checked by testing the approach with mathematical test functions known from literature. The surprising result was that most of these functions behave considerable different from our real world problems, which limits their usefulness drastically.