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In the field of stochastic, population-based optimization methods, PCOpt/NTUA has developed and brought to market the general purpose optimization platform EASY (Evolutionary Algorithm SYstem, http://velos0.ltt.mech.ntua.gr/EASY). EASY s/w can handle any single- or multi-objective, constrained or unconstrained optimisation problem by easily accommodating any analysis software (CFD, CSM tools etc).

The basic feature of EASY is related to the smart use of low-cost surrogate evaluation models (metamodels) during the optimization giving rise to the so-called Metamodel-Assisted Evolutionary Algorithm (MAEA), that are appropriate for computationally demanding optimization problems. In MAEA, "local" metamodels, which are on-line trained for each and every new individual generated during the evolution, are used. For all but the first few generations, the metamodels are used to pre-evaluate the current population. Based on the outcome of approximate pre-evaluations, the most promising population members are identified and these solely undergo evaluation on the problem specific evaluation tool to compute their "exact" objective function value(s), before proceeding to the next generation.

In real-world optimization problems involving a great number of design variables the performance of EAs and/or MAEAs is further enhanced by the use of Principal Component Analysis (PCA) of the design space. The PCA determines a feature space where the evolution operators should preferably be applied in order to enhance the efficiency of EA. In MAEAs the PCA is used to reduce the number of sensory units of metamodels. Thus, the metamodels are trained at much lower computational cost and give better approximation better the objective function value. A Distributed (DMAEAs) variant which is based on a number of sub-populations evolving in semi-isolation is also available.

Over and above, the Hierarchical variant of DMAEAs (HDMAEAs), offers additional CPU cost reduction through the use of multilevel schemes. The latter rely on a two–way regular exchange of information between successive levels. Each level can be associated with different (accuracy/cost) evaluation software, different problem parameterization and/or different search tool, for the minimization of the same objective function(s). In the case of *multilevel evaluation* different evaluation software is assigned to each level. The low level(s) are responsible for detecting near-optimal solutions in the design space at low CPU cost before delivering them to the higher level(s) for further refinement. Inexpensive, low–fidelity evaluation models are associated with lower levels while at the higher levels, evaluation models of higher fidelity and CPU cost are employed. In *multilevel search* each level is associated with a different search technique (EA, conjugate gradient, SQP, etc.). Stochastic search techniques are usually used at the lower levels for the exploration of the design space, leaving the refinement of promising solutions to the gradient based methods at the higher levels. In *multilevel parameterization* each level is associated with a different set of design variables. At the lowest level, a sub–problem with just a few design variables is solved. At the higher levels, the problem dimension increases. The detailed problem parameterization is used at the highest level only.

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