NEW CULTURAL EVOLUTIONARY ALGORITHM USED IN OPTIMAL DESIGN OF MACHINE ELEMENTS

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In this paper, we propose for the first time a new population-based cultural evolutionary mono-objective optimization algorithm. Evolutionary algorithms involving (or not) elitism have many settings. The chosen combination of settings (program tuning) has strong influence on the performance of the algorithm. One of our goals is to conceive an algorithm with the least number of parameters, so that the program itself to be able to set its own parameters for a better evolution (the right configuration at the right time).

The algorithm has a new heuristic (fig. 1) that resembles to a multiannual evolution of a stratified society and its key points are learning and collaboration between individuals. We call this new algorithm *Cultural Multi-Group Evolutionary Algorithm* (CMGEA) and it was implemented in a standalone software called *Proveho v. 1.1* belonging to Optimal Design Center of Technical University of Cluj Napoca, Romania.

```
begin CMGEA
  g : = 0
     { counter }
  Initialize population P(g)
  while g < gMax do
        Initialize_groups G(g)
        for each group in G(g)
              for each individual in group do
                    Assign_interactions(individual)
                    q:= Interactions[individual]
                    while q > 0 do
                          mate:=Select(group)
                          Interact(individual,mate)
                          q:=q-1
                    end while
              end for
        end for
        Evaluate P(g)
        g : = g +1
  end while
end CMGEA
```

Fig. 1 CMGEA pseudocode

We tested this new algorithm with very good results in order to obtain the optimal design of compression springs. The goal of the optimization was to minimize the weight of the spring under an imposed safety factor for fatigue. The problem is also subjected to seven constraints (geometrical, technological, and related to the strength of material).

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