

Appendix 5 Matlab (Version 2010a ©) code for MOGA

MOGA (Code method)

```
1. function [x,fval,exitflag,output,population,score] = MOGA_strategies
   code(nvars,lb,ub,PopulationSize_Data,ParetoFraction_Data,Generations_
   Data)
2. % This is an auto generated M-file from Optimization Tool.
3.
4. % Start with the default options
5. options = gaoptimset;
6. % Modify options setting
7. options = gaoptimset(options,'PopulationSize', PopulationSize_Data);
8. options = gaoptimset(options,'ParetoFraction', ParetoFraction_Data);
9. options = gaoptimset(options,'Generations', Generations_Data);
10.    options = gaoptimset(options,'Display', 'off');
11.    options = gaoptimset(options,'PlotFcns', { @gaplotpareto });
12.    options = gaoptimset(options,'OutputFcns', { [] });
13.    [x,fval,exitflag,output,population,score] = ...
14.    gamultiobj(@mymultil,nvars,[],[],[],[],lb,ub,options);
```

MOGA (Graphic user interface method)

- Open Matlab, access optimization tool, select multiobjective optimization
- Set fitness function as required. (Matlab example 'mymultil' is a 2 objective function code which evenly balances 2 objectives with each other – suitable for any 2 competing objectives such as water and energy (obj 1 = temperature; obj 2 = precipitation))
- Enter number of variables (4 in my case (temp, precip, ground frost frequency, altitude))
- To display within range of 0-1 enter lower bounds [0, 0] and upper bounds [1, 1]
- Population type: Double vector (to reflect objectives in balanced manner)
- Population size: 20
- Creation function (to create the population randomly use constraint dependent default)
- Initial range – may use default or specify initial range [0; 5]
- Pareto front population fraction: 0.7 – 1
- Stopping conditions – Generations 2203-8805 (final population number) to allow these individuals in population
- Plot functions – plot interval 1; select Pareto front
- Allow simulation to run; select linear/quadratic fit to data as required to summarise distribution; identify residual variance by plotting residuals