Gnowee

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Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 5

Namespace Documentation

5.1 Gnowee Namespace Reference

Contains the Gnowee optimization program and associated utilities.

Functions

- def main

5.1.1 Detailed Description

Contains the Gnowee optimization program and associated utilities.

See Also

Gnowee
Gnoweeheuristics
GnoweeUtilities
ObjectiveFunctions
OptiPlot
Sampling
Utilities

5.1.2 Function Documentation

5.1.2.1 def Gnowee.main (*func, lb, ub, varType, S, discreteVals* = [])

```
Main program for the optimization.

Parameters
==========
func : function
    The objective function to be minimized
lb : list or array
    The lower bounds of the design variable(s). Only enter the bounds for continuous and integer/binary variab
ub : list or array
    The upper bounds of the design variable(s). Only enter the bounds for continuous and integer/binary variab
varType : list or array
    The type of variable for each position in the upper and lower bounds array. Discrete variables are to be i
    last as they are specified separatly from the lb/ub throught the discreteVals optional input. A variable c
    types (for example, 'dx' could denote a layer that can take multiple materials and be placed at multiple c
    Allowed values:
    'c' = continuous
```

```
    'i' = integer/binary (difference denoted by ub/lb)
    'd' = discrete where the allowed values are given by the option discreteVals nxm arrary with n=# of discre
          and m=# of values that can be taken for each variable
    'x' = combinatorial.  All of the variables denoted by x are assumed to be "swappable" in combinatorial per
          There must be at least two variables denoted as combinatorial.
    'f' = fixed design variable
S : Object
    An object representing the settings for the Gnowee optimization algorithm

Optional
========
discreteVals : list of list(s)
    nxm with n=# of discrete variables and m=# of values that can be taken for each variable
    Default=[[]]

Returns
=======
timeline : list
    Storage list for design event objects for the current top solution vs generation. Only stores the informat
    new optimal designs are found.
```

Chapter 6

Class Documentation

6.1 GnoweeUtilities.Event Class Reference

Public Member Functions

- def **__init__**

Public Attributes

- **g**
- **e**
- **f**
- **d**

6.1.1 Detailed Description

```
Creates an event object representing a snapshot in the optimization process

Attributes
==========
generation : integer
    The generation the design was arrived at
evaluations : integer
    The number of fitness evaluations done to obtain this design
fitness : scalar
    The assessed design fitness
design : array
    The variables representing the design solution
Returns
=======
None
```

The documentation for this class was generated from the following file:

- /home/pyne-user/Dropbox/UCB/Research/ETAs/Design/Gnowee/src/GnoweeUtilities.py

6.2 Utilities.Event Class Reference

Public Member Functions

- def **__init__**

Public Attributes

- **g**
- **e**
- **f**
- **d**

6.2.1 Detailed Description

```
Creates an event object representing a snapshot in the optimization process

Attributes
==========
generation : integer
    The generation the design was arrived at
evaluations : integer
    The number of fitness evaluations done to obtain this design
fitness : scalar
    The assessed design fitness
design : array
    The variables representing the design solution
Returns
=======
None
```

The documentation for this class was generated from the following file:

- /home/pyne-user/Dropbox/UCB/Research/ETAs/Design/Gnowee/src/Utilities.py

6.3 ObjectiveFunctions.Parameters Class Reference

Public Member Functions

- def **__init__**

Public Attributes

- **lb**
- **ub**
- **o**
- **l**
- **pt**
- **ht**
- **vt**
- **dv**

6.3.1 Detailed Description

```
Creates an parameter object containing key features of the chosen optimization
problem type

Parameters
==========
lower_bounds : array
    The lower bounds of the design variable(s)
upper_bounds : array
    The upper bounds of the design variable(s)
optimum : array
```

```
    The global optimal solution obtained from "Solving Engineering Optimization Problems with the Simple
    Constrained Particle Swarm Optimizer"
label : string array
    The y axis labels
plt_title : string
    The plot title
hist_title : string
    The plot title for the histogram
varType : list or array
    The type of variable for each position in the upper and lower bounds array. Discrete variables are to be i
    last as they are specified separatly from the lb/ub throught the discreteVals optional input. A variable c
    types (for example, 'dx' could denote a layer that can take multiple materials and be placed at multiple c
    Allowed values:
    'c' = continuous
    'i' = integer/binary (difference denoted by ub/lb)
    'd' = discrete where the allowed values are given by the option discreteVals nxm arrary with n=# of discre
          and m=# of values that can be taken for each variable
    'x' = combinatorial.  All of the variables denoted by x are assumed to be "swappable" in combinatorial per
          There must be at least two variables denoted as combinatorial.
    'f' = fixed design variable
     Default=[]
discreteVals : list of list(s)
    nxm with n=# of discrete variables and m=# of values that can be taken for each variable
    Default=[]

Returns
=======
None
```

The documentation for this class was generated from the following file:

- /home/pyne-user/Dropbox/UCB/Research/ETAs/Design/Gnowee/src/ObjectiveFunctions.py

6.4 GnoweeUtilities.Parent Class Reference

Public Member Functions

- def **__init__**

Public Attributes

- **f**
- **d**
- **c**
- **s**

6.4.1 Detailed Description

```
Creates an object representing a current design and associated parameters

Attributes
==========
fitness : float
    The assessed design fitness
design_variables : array
    The variables representing the design solution
    [Used for continuous or discrete optimization]
changes : integer
     The number of improvements found to the current population member
stall : integer
     The number of evals since last improvement
Returns
=======
None
```

The documentation for this class was generated from the following file:

- /home/pyne-user/Dropbox/UCB/Research/ETAs/Design/Gnowee/src/GnoweeUtilities.py

6.5 Utilities.Parent Class Reference

Public Member Functions

- def **__init__**

Public Attributes

- **f**
- **d**
- **i**

6.5.1 Detailed Description

```
Creates a parent object representing a current design

Attributes
==========
fitness : scalar
    The assessed design fitness
design_variables : array
    The variables representing the design solution
    [Used for continuous or discrete optimization]
index : integer
    Represents the starting index for the next generation, which is the last city visited.  (Default=0)
    [Used for TSP problems, ZhouDCS in particular.]
Returns
=======
None
```

The documentation for this class was generated from the following file:

- /home/pyne-user/Dropbox/UCB/Research/ETAs/Design/Gnowee/src/Utilities.py

6.6 Utilities.Settings Class Reference

Public Member Functions

- def **__init__**

Public Attributes

- **p**
- **s**
- **fd**
- **fe**
- **fl**
- **gm**
- **em**
- **ct**

- **sl**
- **of**
- **ot**
- **a**
- **g**
- **n**
- **sf**
- **d**

6.6.1 Detailed Description

```
Creates a object representing the settings for the optimization algorithm

Attributes
==========
population : int
    The number of members in each generation (Default: 25)
initial_sampling : string
    The method used to sample the phase space and create the initial population (Default: 'random')
    Valid('random','nolh','nolh-rp','nolh-cdr',and 'lhc')
frac_discovered : scalar
    Discovery probability (Default: 0.25)
frac_elite : scalar
    Elite fraction (Default: 0.2)
max_gens : int
    The maximum number of generations to search (Default: 10000)
feval_max : int
    The maximum number of objective function evaluations (Default: 100000)
conv_tol : scalar
    The minimum change of the best objective value before the search
    terminates (Default: 1e-5)
stall_iter_limit : int
    The maximum number of genrations to search without a descrease
    exceeding conv_tol (Default: 200)
optimal_fitness : scalar
    The best know fitness value for the problem considered (Default: 0)
opt_conv_tol : scalar
    The maximum deviation from the best know fitness value before the search
    terminates (Default: 1e-2)
alpha : scalar
    Levy exponent - defines the index of the distribution and controls scale properties of the stochastic proc
    (Default: 1.5)
gamma : scalar
    Gamma - Scale unit of process for Levy flights (Default: 1)
n : integer
    Number of independent variables - can be used to reduce Levy flight variance (Default: 1)
scaling_factor : scalar
    Step size scaling factor used to adjust Levy flights to length scale of system (Default: 100)
step_size : scalar
    Step size parameter used for generational cooling (Default: 1.0)
debug : boolean
    If True, progress statements will be displayed every iteration
    (Default: False)
Returns
=======
None
```

The documentation for this class was generated from the following file:

- /home/pyne-user/Dropbox/UCB/Research/ETAs/Design/Gnowee/src/Utilities.py

6.7 GnoweeUtilities.Settings Class Reference

Public Member Functions

- def **__init__**

Public Attributes

- **p**
- **s**
- **fd**
- **fe**
- **fl**
- **gm**
- **em**
- **ct**
- **sl**
- **of**
- **ot**
- **a**
- **g**
- **n**
- **sf**
- **pen**

6.7.1 Detailed Description

```
Creates a object representing the settings for the optimization algorithm

Attributes
==========
population : int
    The number of members in each generation (Default: 25)
initial_sampling : string
    The method used to sample the phase space and create the initial population (Default: 'random')
    Valid('random','nolh','nolh-rp','nolh-cdr',and 'lhc')
frac_discovered : scalar
    Discovery probability (Default: 0.25)
frac_elite : scalar
    Elite fraction (Default: 0.2)
max_gens : int
    The maximum number of generations to search (Default: 10000)
feval_max : int
    The maximum number of objective function evaluations (Default: 100000)
conv_tol : scalar
    The minimum change of the best objective value before the search
    terminates (Default: 1e-5)
stall_iter_limit : int
    The maximum number of genrations to search without a descrease
    exceeding conv_tol (Default: 200)
optimal_fitness : scalar
    The best know fitness value for the problem considered (Default: 0)
opt_conv_tol : scalar
    The maximum deviation from the best know fitness value before the search
    terminates (Default: 1e-2)
alpha : scalar
    Levy exponent - defines the index of the distribution and controls scale properties of the stochastic proc
    (Default: 1.5)
gamma : scalar
    Gamma - Scale unit of process for Levy flights (Default: 1)
n : integer
    Number of independent variables - can be used to reduce Levy flight variance (Default: 1)
scaling_factor : scalar
    Step size scaling factor used to adjust Levy flights to length scale of system (Default: 10)
penalty : scalar
    Individual constraint violation penalty to objective function (Default: 0.0)
```

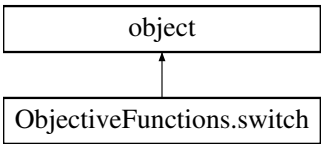
```
Returns
=======
None
```

The documentation for this class was generated from the following file:

- /home/pyne-user/Dropbox/UCB/Research/ETAs/Design/Gnowee/src/GnoweeUtilities.py

6.8 ObjectiveFunctions.switch Class Reference

Inheritance diagram for ObjectiveFunctions.switch:



Public Member Functions

- def **__init__**
- def __iter__
- def match

Public Attributes

- **value**
- **fall**

6.8.1 Detailed Description

```
Creates a switch class object to switch between cases

Parameters
==========
value : string
    case selector value
Returns
=======
True or False based on match
```

6.8.2 Member Function Documentation

6.8.2.1 def ObjectiveFunctions.switch.__iter__ (*self*)

```
Return the match method once, then stop
```

6.8.2.2 def ObjectiveFunctions.switch.match (*self, args*)

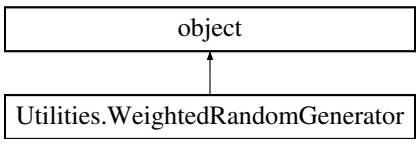
```
Indicate whether or not to enter a case suite
```

The documentation for this class was generated from the following file:

- /home/pyne-user/Dropbox/UCB/Research/ETAs/Design/Gnowee/src/ObjectiveFunctions.py

6.9 Utilities.WeightedRandomGenerator Class Reference

Inheritance diagram for Utilities.WeightedRandomGenerator:



Public Member Functions

- def **__init__**
- def **next**
- def **__call__**

Public Attributes

- **totals**

6.9.1 Detailed Description

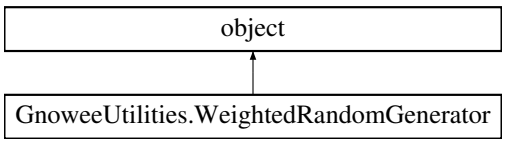
```
Defines a class of weights to be used to select number of instances in array randomly with
linear weighting.

Parameters
==========
self : object
    Current instance of the class
weights : array
    The array of weights (Higher = more likely to be selected)

Returns
=======
bisect.bisect_right(self.totals, rnd) : integer
    The randomly selected index of the weights array
```

The documentation for this class was generated from the following file:

- /home/pyne-user/Dropbox/UCB/Research/ETAs/Design/Gnowee/src/Utilities.py

6.10 GnoweeUtilities.WeightedRandomGenerator Class Reference

Inheritance diagram for GnoweeUtilities.WeightedRandomGenerator:



Public Member Functions

- def **__init__**

- def **next**
- def **__call__**

Public Attributes

- **totals**

6.10.1 Detailed Description

```
Defines a class of weights to be used to select number of instances in array randomly with
linear weighting.

Parameters
==========
self : object
    Current instance of the class
weights : array
    The array of weights (Higher = more likely to be selected)

Returns
=======
bisect.bisect_right(self.totals, rnd) : integer
    The randomly selected index of the weights array
```

The documentation for this class was generated from the following file:

- /home/pyne-user/Dropbox/UCB/Research/ETAs/Design/Gnowee/src/GnoweeUtilities.py

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