
elegant Documentation

Release 1.0b1

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elegant is a Pure Python Power Systems Simulator. The latest development version can be found [here](#).

CHAPTER 1

Installation

`elegant` requires `numpy` (for linear algebra), `PyQt5` (for the GUI), `pylatex` (to generate reports), `matplotlib` (for plotting), and `networkx` (for multigraph data structures)

Installing the most recent stable version of the package is as easy as:

```
python3 -m pip install elegant
```


2.1 1.0 (2020-00-00)

Initial beta release

2.1.1 Case Study

Inserting buses

Inserting lines

Inserting loads

2.1.2 API

This page details the methods and classes provided by the `elegant` module.

Top-Level classes

```
class elegant.core.Bus (bus_id, v=1.0, delta=0.0, pg=0.0, qg=0.0, pl=0.0, ql=0.0, xd=inf,  
                       iTPG=None, iSLG=None, iDLGb=None, iDLGc=None, iLL=None,  
                       gen_ground=False, load_ground=1)
```

Bases: `object`

```
P
Q
Z
class elegant.core.Keys
    Bases: object
    add_keyobj (extremities, path, obj)
    get_keyobj (extremities, path)
    have_extremities (extremities)
class elegant.core.PowerSystem
    Bases: object
    M
    N
    Y
    Y0
    Y1
    add_bus ()
    add_line (line, path=None)
    add_trafo (trafo, path=None)
    good_ids
    hsh
    id2n (k)
    masked_buses
    masked_lines
    masked_trafos
    remove_bus (n)
    remove_elements_linked_to (bus)
    remove_line (line, key=None)
    remove_trafo (trafo, key=None)
    sort_buses ()
    update (Nmax=100)
    update_flow (Nmax=100)
    update_short ()
class elegant.core.Transformer (orig, dest, snom=100000000.0, jx0=0.5, jx1=0.5, primary=0,
                                secondary=0, v1=0.0, v2=0.0)
    Bases: object
    Ipu
    S1
    S2
```

Sper

z0

z1

```
class elegant.core.TransmissionLine(orig, dest, ell=10000.0, r=0.01, d12=1, d23=1, d31=1,  
                                     d=0.5, rho=1.78e-08, m=1, vbase=10000.0, imax=inf,  
                                     v1=0.0, v2=0.0, z=None, y=None)
```

Bases: `object`

Ia

Ipu

Rb

Rm

s1

s2

Sper

Tpu

Y

Ypu

z

zc

zcpu

zpu

gamma

param

`elegant.core.gmean(arr)`

Numerical Methods

`elegant.methods.short(Y1, Y0, V)`

Calculates three-phase short circuit current levels for each bus

Parameters

Y1: array, shape (N,N) Positive-sequence bus admittance matrix

Y0: array, shape (N,N) Zero-sequence bus admittance matrix

V: array, shape (N,) Pre-fault voltage levels for each bus

Returns

I: array, shape (N, 4, 3) Three-phase current levels for each of the N buses for each of the following fault types:

- Three-phase to ground (TPG);
- Single-line to ground (SLG);
- Double-line to ground (DLG);

- Line-to-line (LL)

`elegant.methods.gauss_seidel` (*Y*, *V0*, *S*, *eps=None*, *Niter=1*, *Nmax=1000*)
Gauss-Seidel Method

Parameters

Y: array, shape (N,N) Ybus matrix
V0: array, shape (N,) Complex initial guess
S: array, shape (N,2) Specified apparent power
eps: float, optional Tolerance
Niter: int, optional Minimum number of iterations (default=1)

Returns

V: array, shape (N,) Bus voltage approximations

`elegant.methods.newton_raphson` (*Y*, *V0*, *S*, *eps=None*, *Niter=1*, *Nmax=1000*)

Parameters

Y: admittance matrix
V0: array with initial estimates (1, N)
S: array with specified powers in each bar (N, 2)
eps: defined tolerance, default = None
Niter: max number of iterations, default = 1

Returns

V0: updated array with estimates to the node tensions (1, N)

Report files

`elegant.report.create_report` (*system*, *curves*, *grid*, *filename*)

CHAPTER 3

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