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Development of Custom Codes for Cooperation with PSAT MATLAB Toolbox and Easy SSSC-OPF Optimization in Power Systems

Farhad Gh. Khodaei, Master's Student of Power Systems, University of Bonab, Bonab, Iran
e-mail: fkg1082@gmail.com

Abstract. In power systems dynamic analysis, one of the well-known used toolboxes is Power System Analysis Toolbox (PSAT). In order to easy cooperate with this toolbox, custom codes are required to do complicated optimization computations automatically and without much effort by the user. In this article, a simple code was proposed for this aim. It can be a base technique to write user defined optimization programs to be run fast and reliable without difficulties of handy manipulation of numbers by the user, especially for Small Signal Stability Constrained Optimal Power Flow (SSSC-OPF) optimizations.

Keywords: Power System Analysis Toolbox, MATLAB, Simulink, Power Systems, Optimization, Small Signal Stability.

The proposed code is for the data file with the name of “d_009.mdl” which should be set immediately after PSAT loads. Then run the following script:

```
%load current path
cd(Path.data);

%set name of simulunk model file
open_system('d_009');

%set PV bus elements active power
set_param('d_009/PV', 'p4q', num2str(0.8));
set_param('d_009/PV1', 'p4q', num2str(0.9));

%do power flow and small signal
stability analysis
```

```
%initialization
Settings.init=0;
Settings.pq2z=1;
clpsat.init=1;
clpsat.pq2z=1;

%analysis
fm_eigen('runsssa');
fm_eigen('As');
eig_result=SSSA.eigs
```

In this code, first the path is set, and then the Simulink model is opened. The Simulink file name should be equal with the data file name which was set initially. Then the active powers of the Simulink Blocks of PV and PV1 in the file “d_009.mdl” are set (here to 0.8 and 0.9 per-unit). The list of the parameters of the object “d_009/PV” that one of them is “p4q” (for the active power) can be found by the code:

```
get_param('d_009/PV', 'ObjectParameters');
```

The initializations in the continuation of the code are required to do the power flow analysis at each run and also for correct dynamic analysis with constant impedance model for loads. Finally, the elements of the vector eig_result will be the eigenvalues of the matrix “ A_s ” as described in Power System Analysis Toolbox (PSAT) documents [1].

Reference

[1] F. Milano, "An open source power system analysis toolbox," in IEEE Transactions on Power Systems, vol. 20, no. 3, pp. 1199-1206, Aug. 2005.