

# Network Reduction Toolbox

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The network reduction toolbox performs a modified Ward reduction. Two input arguments are required by the toolbox: the (original) full power flow base case model in MATPOWER [1] format and a user-defined list of the external bus indices, i.e., buses to be eliminated. The output of the toolbox includes three arguments: a reduced power flow model file in MATPOWER format; a matrix providing the new generator-to-bus assignment, which lists to which buses the external generators are moved; and a branch circuit number vector indicating which branches are equivalent lines. For details about the inputs and outputs, please refer to the help for each of the functions. Every function in the toolbox includes help text that describes the function of the routine and the format of the input and the output data.

## 1 Components

The package includes two components:

- a. The reduction software, including all routines to generate the reduced model.
- b. An example file which can be used to demonstrating network reduction on a 9 bus system (case file `case9`). To run the example, please open and run the file `Example_9bus.m`. This file generates a reduced model of a 9 bus system by eliminating 3 buses. A more detailed description of the reduction process and output files are included in the file.

## 2 Installation

To install the toolbox, simply add the `$MATPOWER/extras/reduction` directory to your Matlab path, where `$MATPOWER` denotes the directory where MATPOWER is installed.

### 3 How to use

The basic steps to using this software are:

- a. Read in the input full model data using the `loadcase` function (a MATPOWER function to load the case file).
- b. Generate a list of external bus indices.
- c. Call the function `MPReduction` to perform the reduction and generate the outputs listed above.

### 4 Citing

If you publish results based on the use of this toolbox, we request that you please cite reference [3] below.

#### *References*

- [1] R. D. Zimmerman, C. E. Murillo-Sánchez, and R. J. Thomas, "MATPOWER: Steady-State Operations, Planning and Analysis Tools for Power Systems Research and Education," *Power Systems, IEEE Transactions on*, vol. 26, no. 1, pp. 12–19, Feb. 2011.
- [2] Ray D. Zimmerman, Carlos E. Murillo-Sánchez, *MATPOWER 5.1 User's Manual*, Available at: <http://www.pserc.cornell.edu/matpower/docs/MATPOWER-manual-5.1.pdf>.
- [3] Di Shi; Shawhan, D.L.; Nan Li; Tylavsky, D.J.; Taber, J.T.; Zimmerman, R.D.; Schulze, W.D., "Optimal generation investment planning: Pt. 1: network equivalents," *North American Power Symposium (NAPS)*, 2012, vol., no., pp.1,6, 9-11 Sept. 2012.