Continuation Power Flow Analysis

Lab 2

EEEN50100 - Stability Analysis of Nonlinear Systems

Exercises

1. Solve the continuation power flow analysis of the IEEE 14-bus system without enforcing reactive power limits of PV and slack generators for different loading levels and determine the maximum loading level at which a solution can be obtained. Indicate also the type of bifurcation point that leads to the maximum loading condition.
2. Solve the continuation power flow analysis of the IEEE 14-bus system enforcing reactive power limits of PV and slack generators for different loading levels and determine the maximum loading level at which a solution can be obtained. Indicate also the type of bifurcation point that leads to the maximum loading condition.
3. Discuss the effect of different predictor and the corrector methods on the performance of the continuation power flow routine.
4. Try to obtain "all" power flow solutions using the continuation power flow analysis tool. Discuss the "quality" of the solutions and the type of bifurcation points encountered.

Data File

Use the file `ieee14_static.dm` that can be found in the collection of data files on the module website. Set `qmax = 1` for the device `Slack`. Remove any `ALTER` commands from the original data file.

Hints

- The continuation power flow analysis can be solved using the command:

  ```
  >> dome -r CPF ieee14_static.dm
  ```

  Help on available options can be obtained using the command:

  ```
  >> dome -A CPF
  ```

- To solve Exercise 1, set `CPF.reactive_limits = False`.
- To solve Exercise 2, set `CPF.reactive_limits = True`.
- For all exercises, set `CPF.single_slack = False` and that `CPF.mu_init = 1`. Be aware that, if `CPF.single_slack = True`, Dome ignores reactive power limits of the device `Slack` even if `CPF.reactive_limits = True`
- While solving Exercises 1 and 2, set `CPF.ending = 'nose'` to obtain the complete "nose" curve. Note that one can face numerical issues depending on the corrector and predictor method used. Typically the most critical step is the corrector method. If the default corrector method does not work, try using alternative methods. The number of points required to complete the bifurcation diagram depends on the option `CPF.step`. A small `CPF.step` is numerically more stable but requires more points, so one has to set a big value for `CPF.points`.
- For Exercise 4, use preferably `CPF.corrector = 'PI'` and set `CPF.ending = 'allsol'` and `CPF.reactive_limits = False`. A large number of points will be required, e.g., `CPF.points = 2000`. It may be useful to adjust the option `CPF.transcritical`.
- The results of the continuation power flow can be plotted using `domeplot` with the same options as the results of the time domain simulations. The index 0 corresponds to the continuation parameter μ.