Raw

Table 1 | Voltage stability condition applied to 11 test networks.

Numerical testing of theoretical predictions

Test case (1,000 instances)	Condition correctness	Exact deviation (δ_{exact})	Predicted deviation (δ_{-})	Condition accuracy
9 bus system	True	$5.50 \cdot 10^{-2}$	$5.52 \cdot 10^{-2}$	$3.56 \cdot 10^{-3}$
14 bus system	True	$2.50 \cdot 10^{-2}$	$2.51 \cdot 10^{-2}$	$1.96 \cdot 10^{-3}$
RTS 24	True	$3.28 \cdot 10^{-2}$	$3.29 \cdot 10^{-2}$	$3.28 \cdot 10^{-3}$
30 bus system	True	$4.72 \cdot 10^{-2}$	$4.75 \cdot 10^{-2}$	$7.64 \cdot 10^{-3}$
New England 39	True	$5.95 \cdot 10^{-2}$	$5.99 \cdot 10^{-2}$	$5.97 \cdot 10^{-3}$
RTS '96 (2 area)	True	$3.44 \cdot 10^{-2}$	$3.45 \cdot 10^{-2}$	$3.81 \cdot 10^{-3}$
57 bus system	True	$0.97 \cdot 10^{-1}$	$0.99 \cdot 10^{-1}$	$2.97 \cdot 10^{-2}$
RTS '96 (3 area)	True	$3.57 \cdot 10^{-2}$	$3.58 \cdot 10^{-2}$	$3.94 \cdot 10^{-3}$
118 bus system	True	$2.68 \cdot 10^{-2}$	$2.69 \cdot 10^{-2}$	$3.63 \cdot 10^{-3}$
300 bus system	True	$1.32 \cdot 10^{-1}$	$1.36 \cdot 10^{-1}$	$3.03 \cdot 10^{-2}$
Polish 2,383 system	True	$4.03 \cdot 10^{-2}$	$4.06 \cdot 10^{-2}$	$8.55 \cdot 10^{-3}$

Condition correctness is whether the implication $\Delta = \left\|\mathbf{Q}_{crit}^{-1}\mathbf{Q}_{L}\right\|_{\infty} < 1 \Rightarrow \delta_{exact} \leq \delta_{-}$ holds for every network realization, where $\delta_{-} = \frac{1}{2}\left(1 - \sqrt{1-\Delta}\right)$ and δ_{exact} is determined numerically. Exact and predicted deviations are averaged values of the respective quantities over all realizations. Condition accuracy is calculated as $(\delta_{-} - \delta_{exact})/\delta_{exact}$, and averaged over 1,000 randomized instances for each network, with 30% of generation (resp. 30% of load) randomized by 30% (resp. 50%) using a normal distribution centred around base conditions.

Recurrent

1000 instances	exact deviation	predict deviation	condition accuracy
9 bus	0.050542676	0.050994772	0.008944842
14 bus	0.026330469	0.028207044	0.071270076
24 bus	0.034816796	0.034793082	6.81E-04
30 bus	0.031184204	0.033627384	0.078346723
39 bus	0.057492414	0.057879712	0.0067365
57 bus	0.097614389	0.113835569	0.166176115
118 bus	0.028035288	0.028768747	0.026161973
300 bus	0.122098382	0.124044692	0.015940503
2383bus	0.041593229	0.046935966	0.128452066