

Fig. 3. Reference rotor-side voltage  $v_{dq}$ , due to active power control.

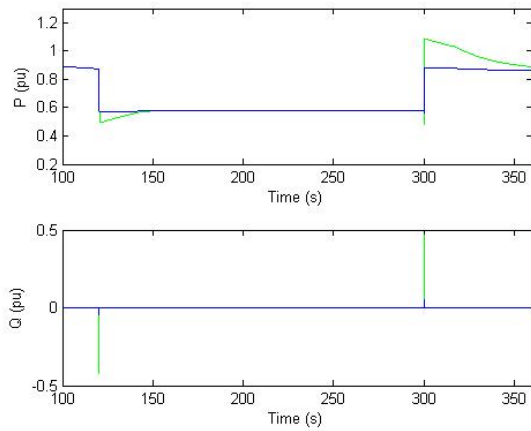


Fig. 4. Active power and reactive power, due to active power control.

A phase-to-earth fault in a line of the electrical network located near the wind park occurred at  $t=180$  s with a duration of 180 ms. The fault impedance was 1 m $\Omega$ . Figures 5 and 6 show the signals of the reference voltages used to control the stator-side and the rotor-side converters, with NNs (in the blue colour) and PIs (in the green colour).

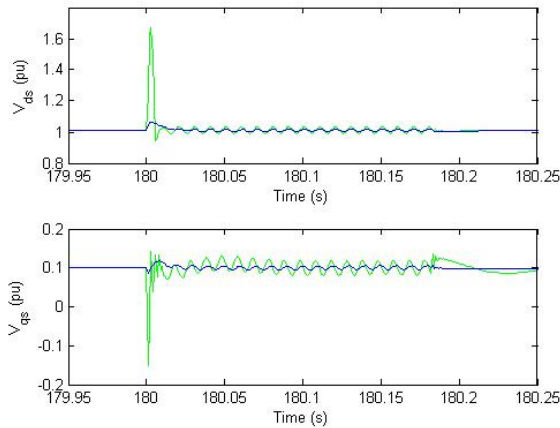


Fig. 5. Reference grid-side voltage  $v_{dq}$ , due to a phase-to-earth fault.

During the fault period, it was verified that the NNs response presents better results than the system using PI

controllers; beside the peaks already related previously in the transitions, they present a lesser ripple. It is important to relate that in the direct component of the stator voltage with PI controllers the peaks can reach about 1,7 p.u. and that can cause some unwanted effects in the electronic devices used in the converters.

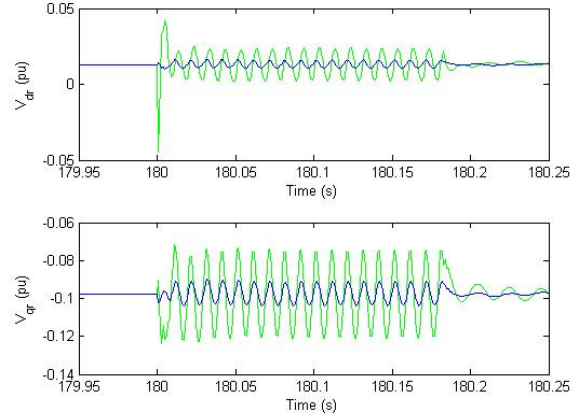


Fig. 6. Reference rotor-side voltage  $v_{dq}$ , due to a phase-to-earth fault.

The disturbances caused in the active power and reactive power delivered to the grid are smoother with the use of the NNs.

### 3. Conclusion

The NN-based system that estimates the control parameters of the generator shown good characteristics, as was verified in the presented results. Some differences in the controllers responses using neural networks can be noticed, namely three positive and advantageous aspects: transient regimes present smaller overshoots, or absence of them in some cases, what corresponds to less severe transitions; a faster response, i.e. the system retakes the permanent regimen in lesser time; and smaller oscillatory behaviour.

It was demonstrated that the reference signals for the grid-side and rotor-side converters of the DFIG can be obtained using control systems based in NNs. These can substitute most of the blocks of a conventional control system, and with the referred advantages.

### References

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