

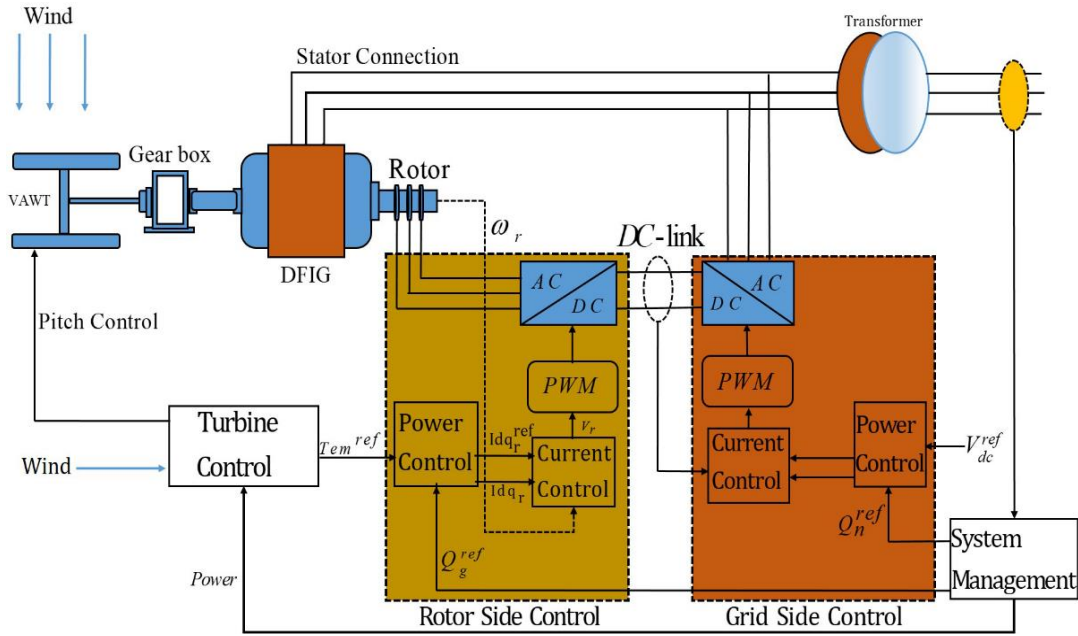


Fig. 1 VAWT based wind energy conversion system

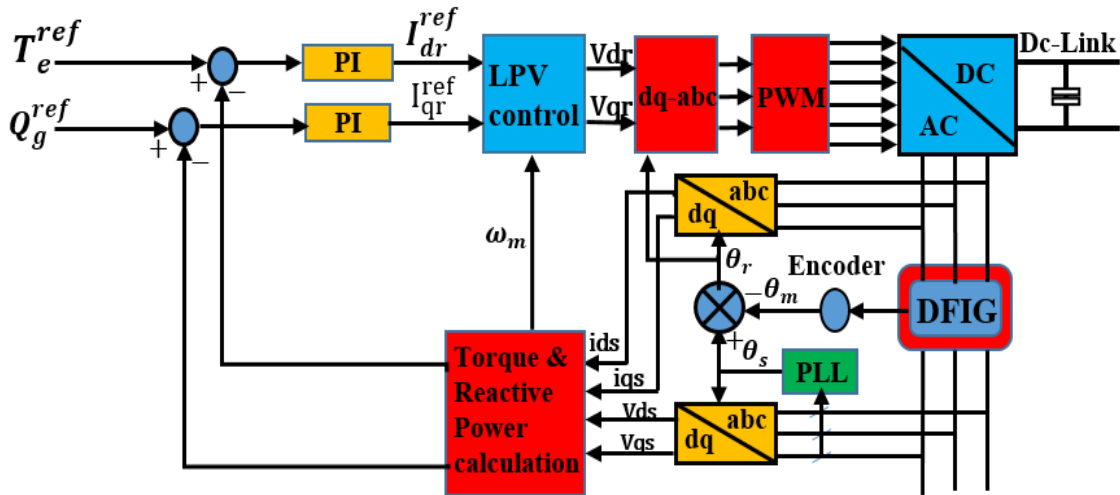


Fig. 2 Rotor side control structure

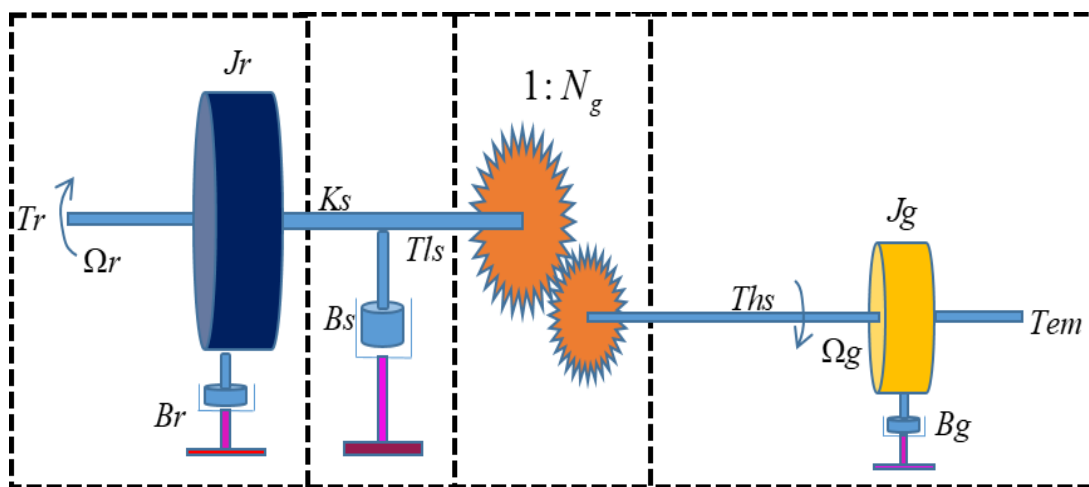


Fig. 3 Two mass drive train

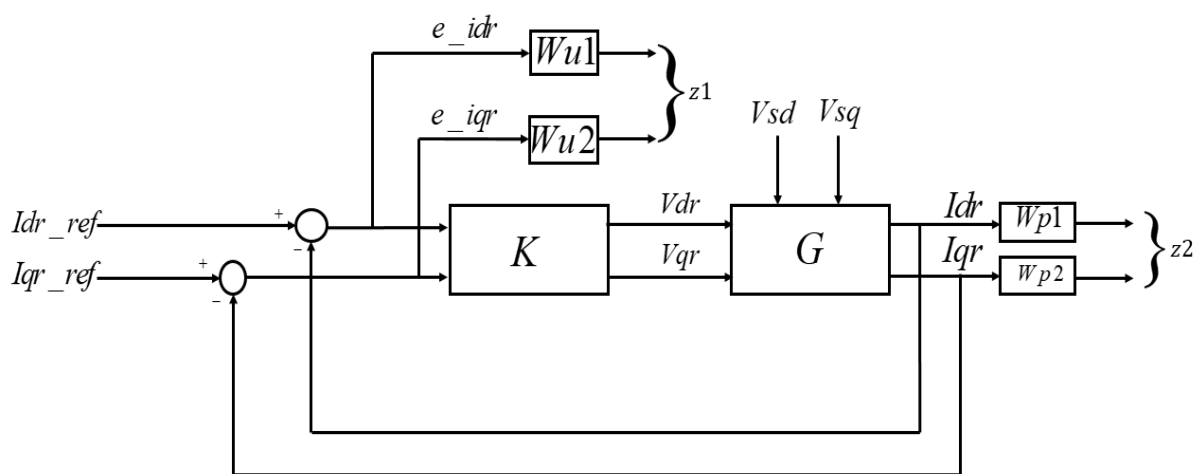


Fig. 4 System interconnection with the controller and weighting functions

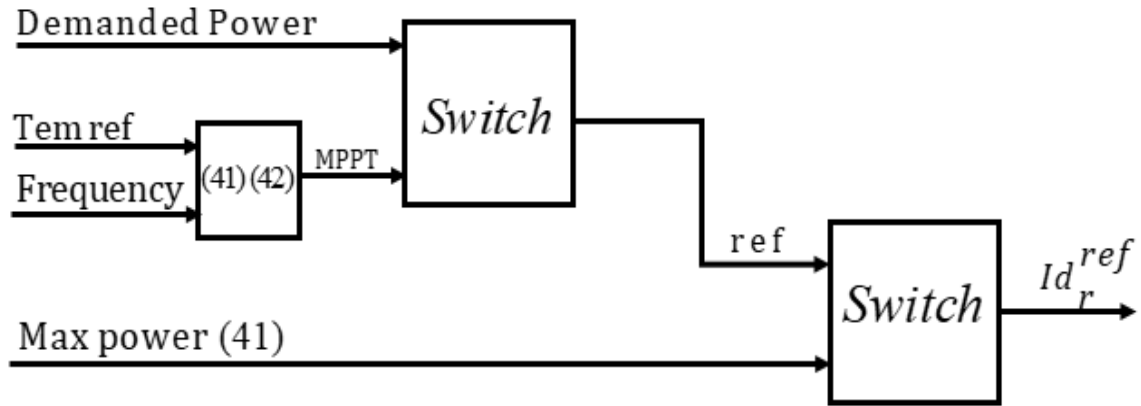


Fig. 5 Electrical torque control connection

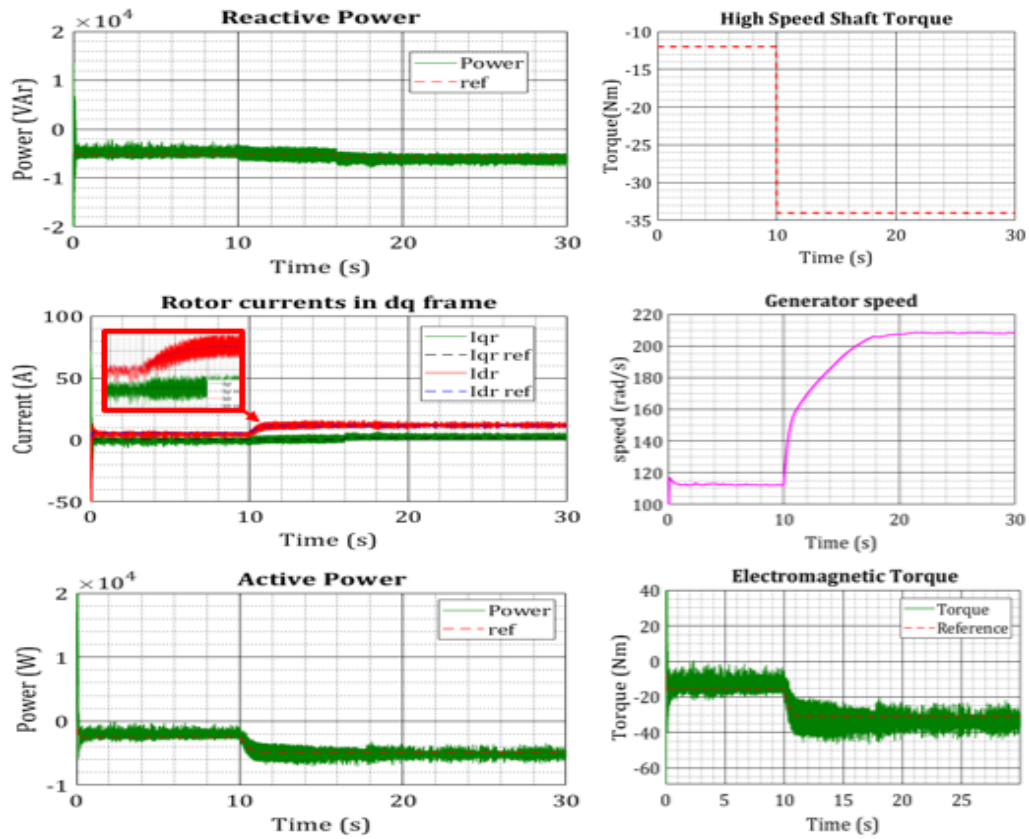


Fig. 6 Tracking performance of the self-scheduled controller

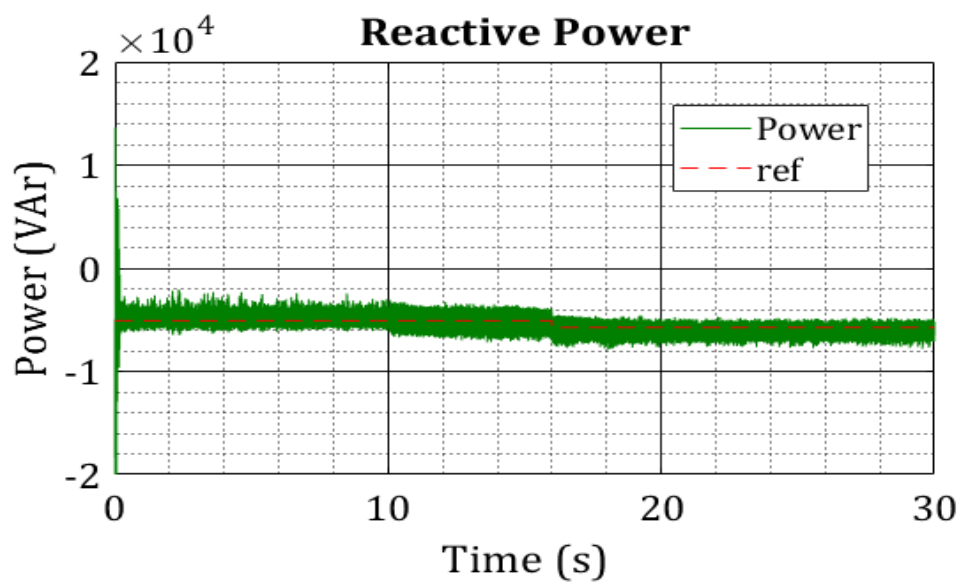


Fig 6. (a) Reactive power

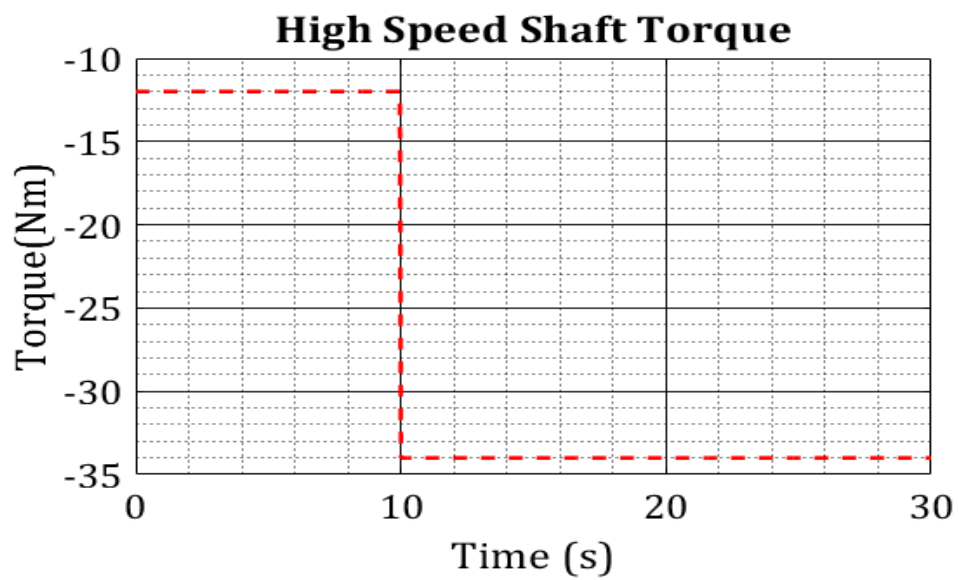


Fig 6. (b) High speed shaft torque

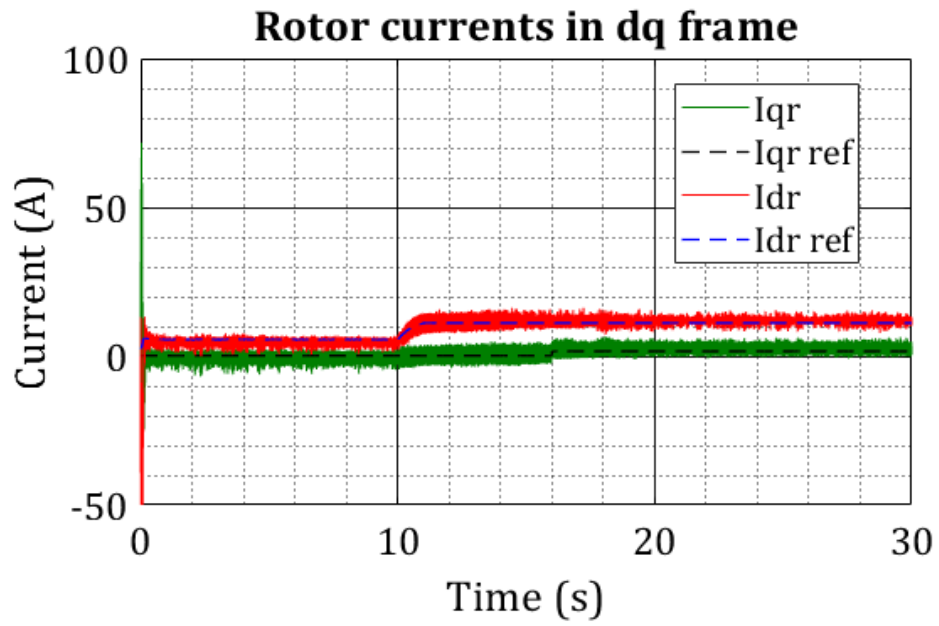


Fig 6. (c) Rotor currents in d-q frame

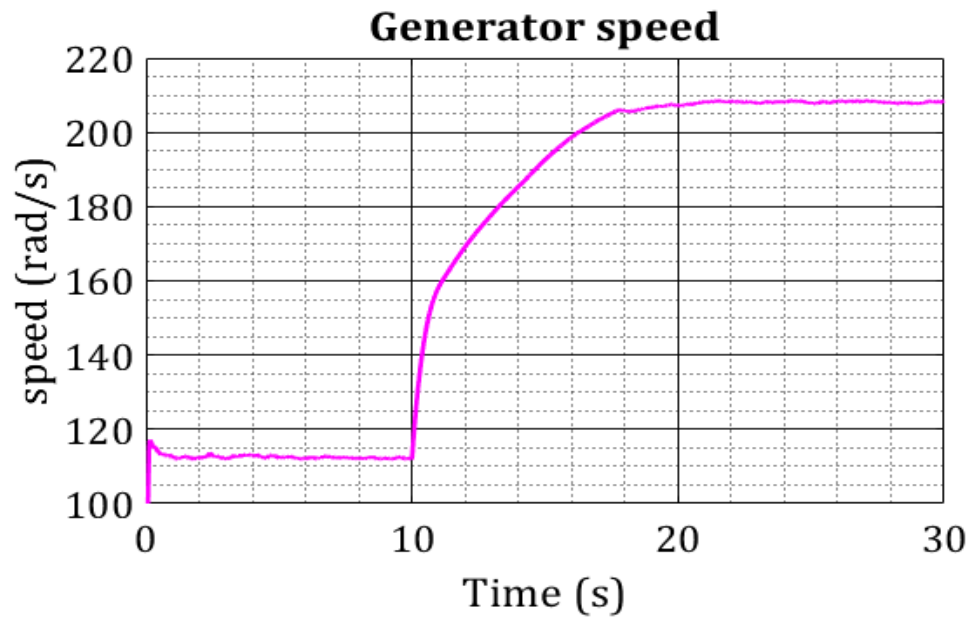


Fig 6. (d) Generator speed

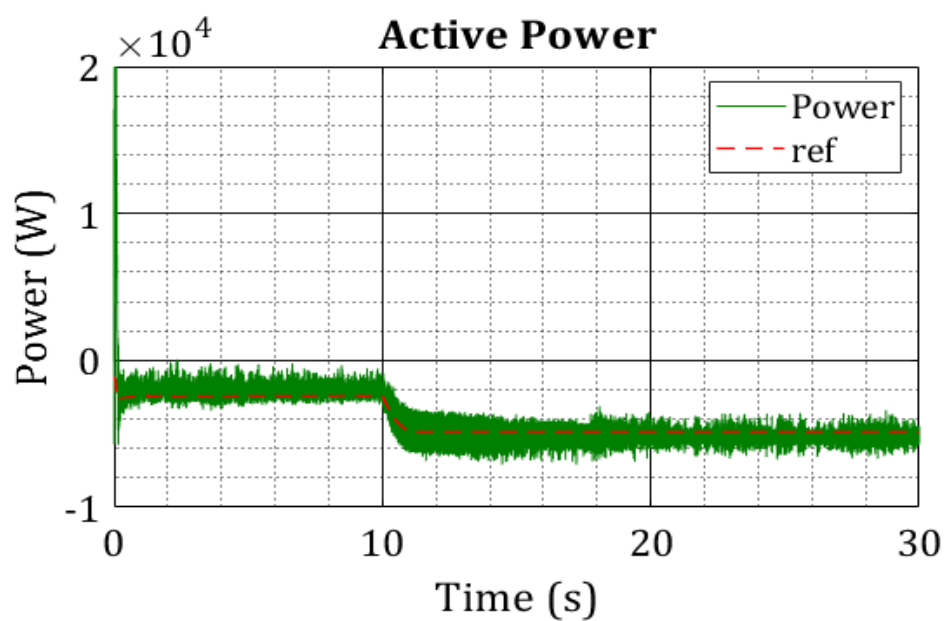


Fig 6. (e) Active power

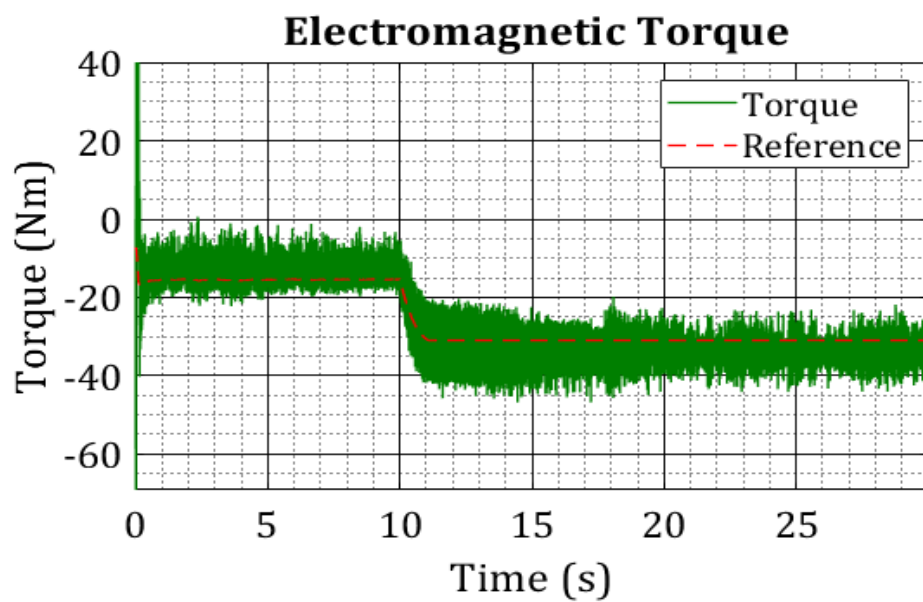


Fig 6. (f) Electromagnetic torque

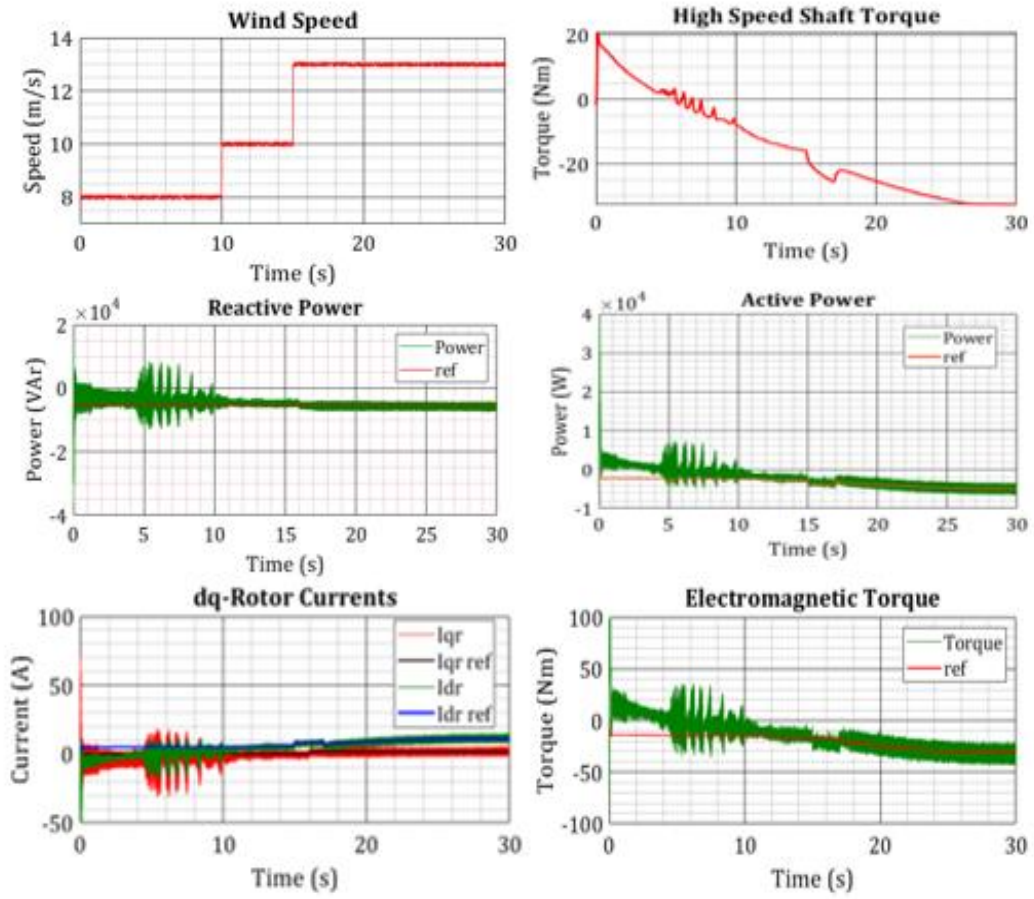


Fig. 7 Performance of the DFIG connected to the VAWT with start-up characteristics

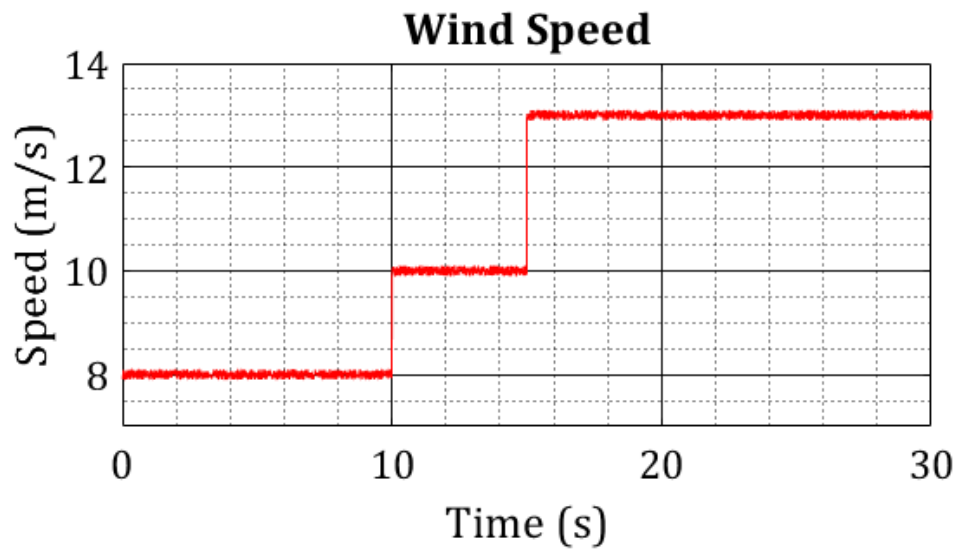


Fig.7. (a) Wind speed

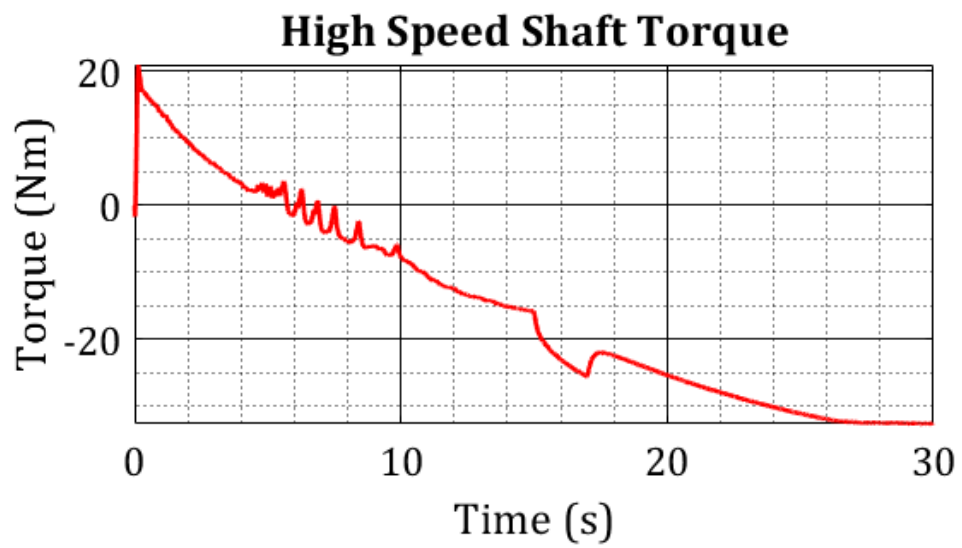


Fig.7. (b) High speed shaft torque

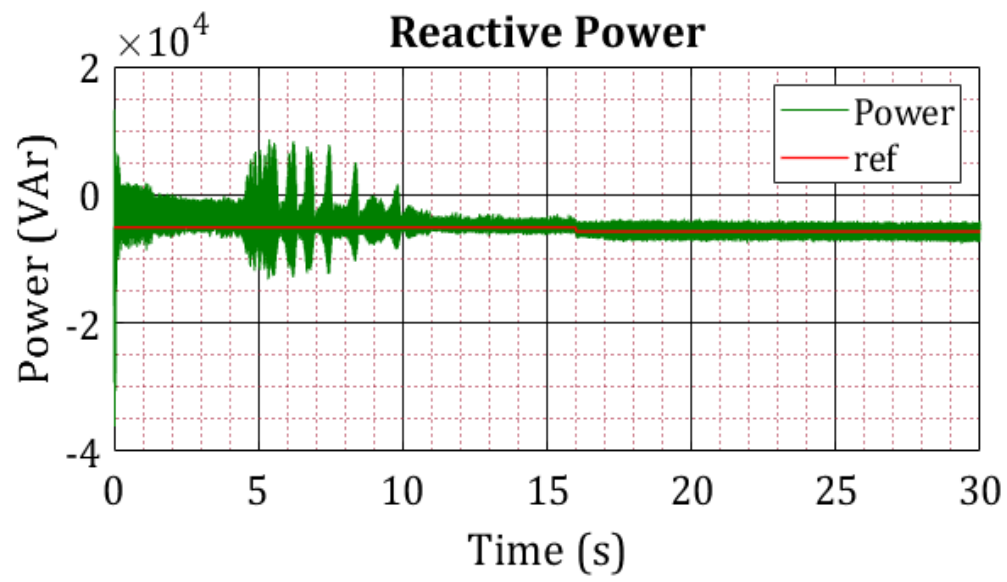


Fig.7. (c) Reactive power

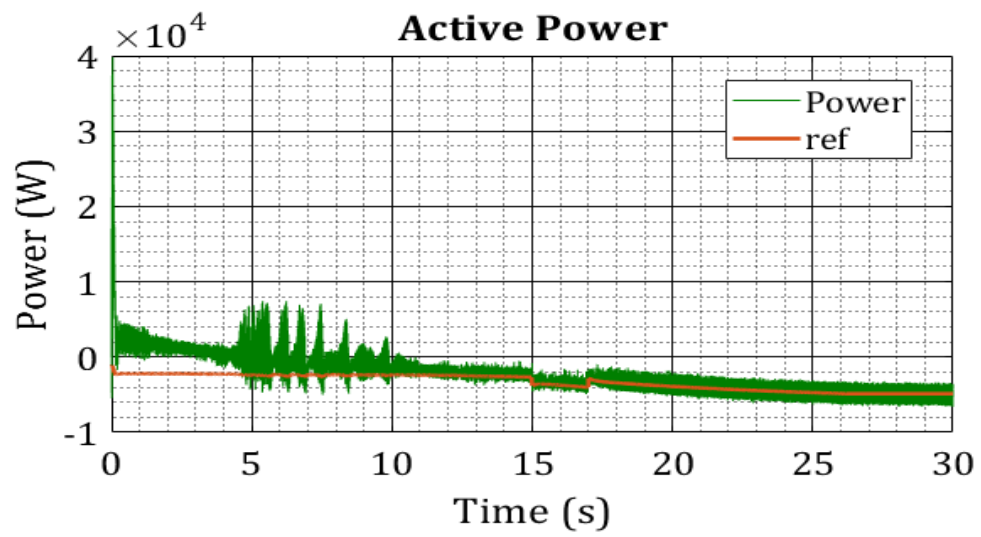


Fig.7. (d) Active power

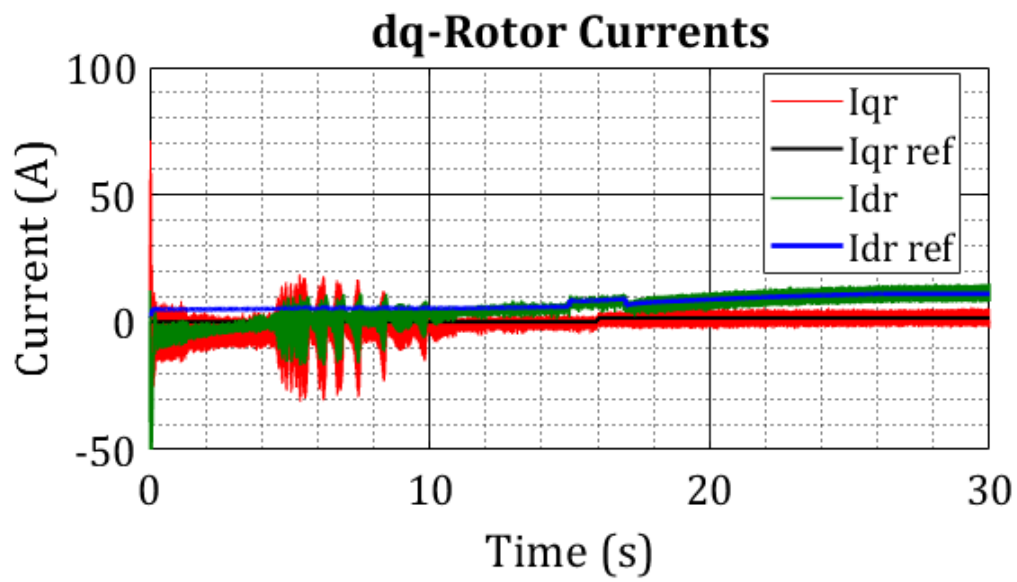


Fig.7. (e) d-q rotor currents

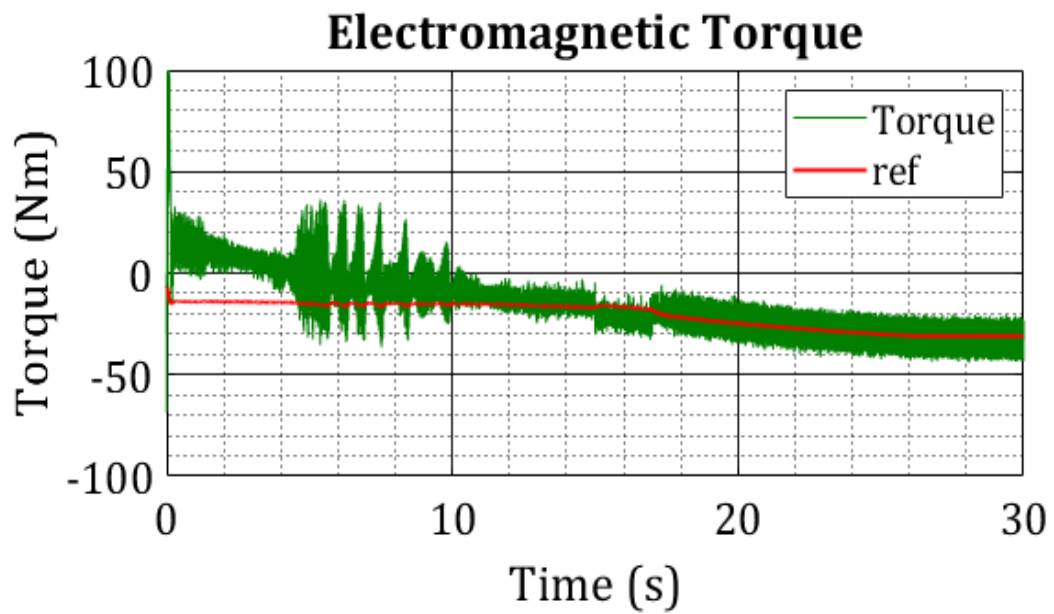


Fig.7. (f) Electromagnetic torque

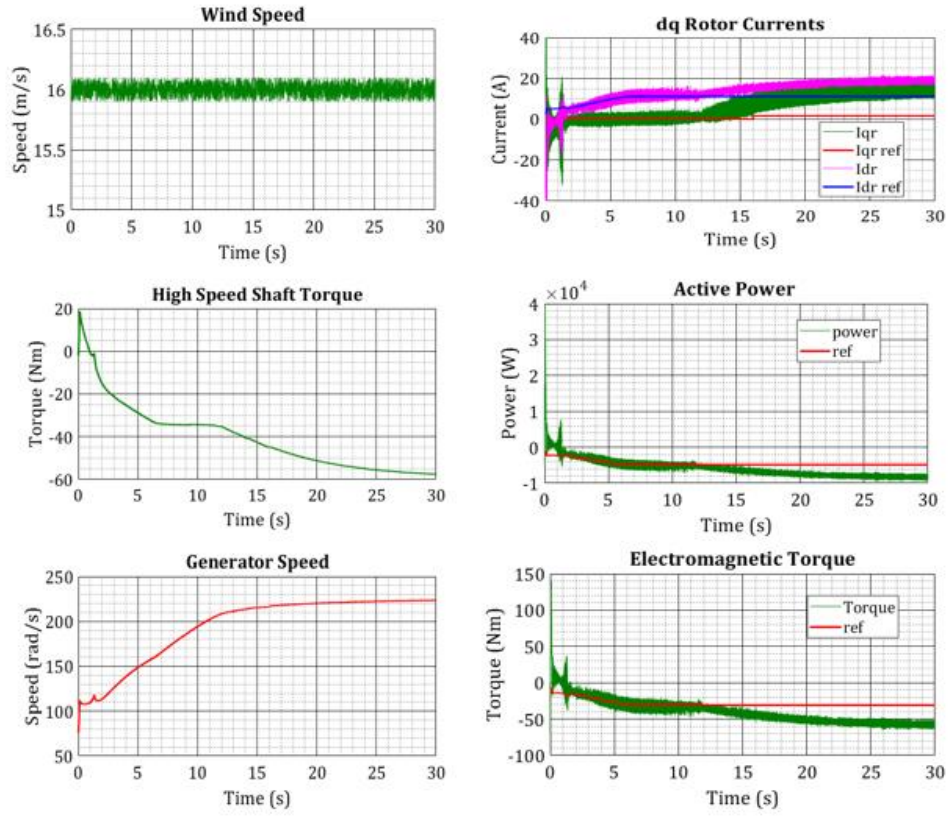


Fig. 8 Torque control of the VAWT above rated wind speeds

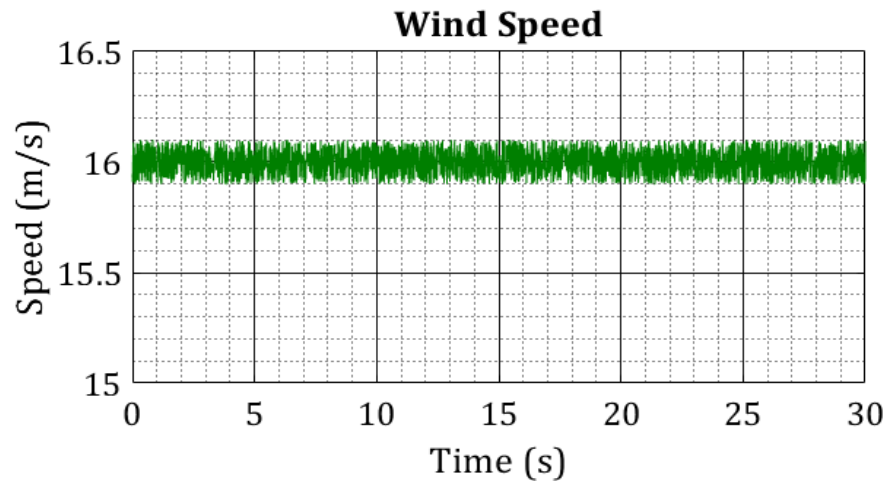


Fig. 8. (a) Wind speed

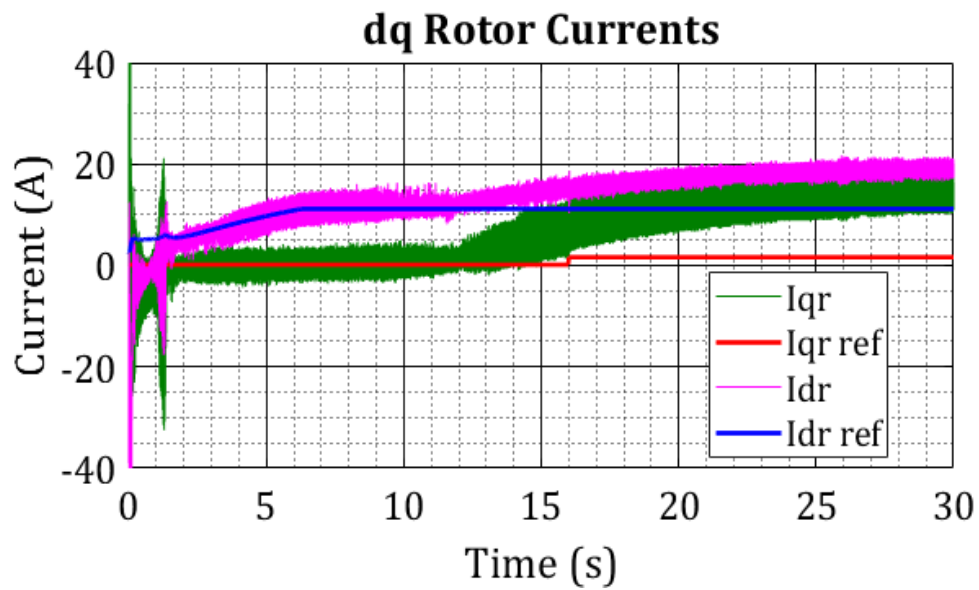


Fig. 8. (b) d-q rotor currents

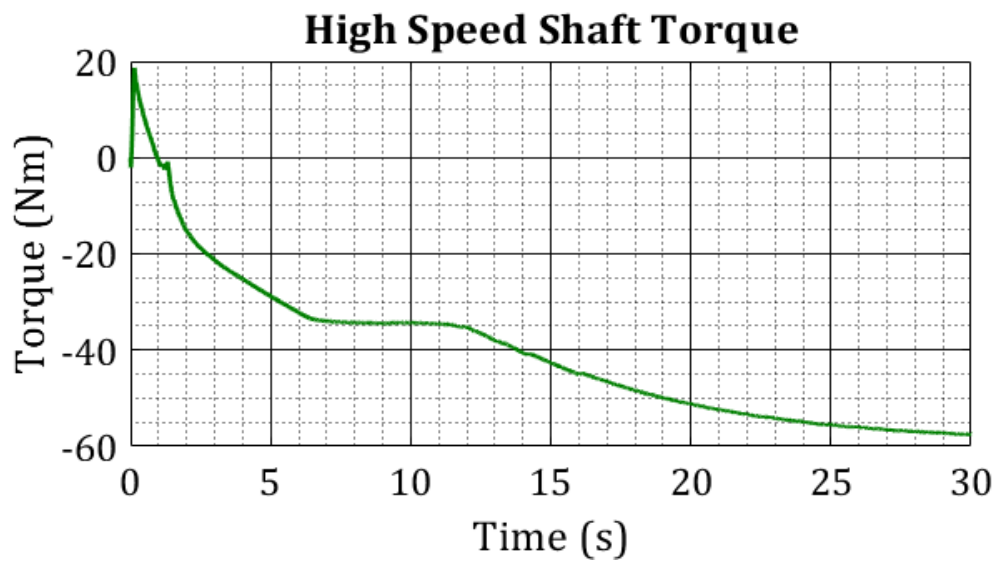


Fig. 8. (c) High speed shaft torque

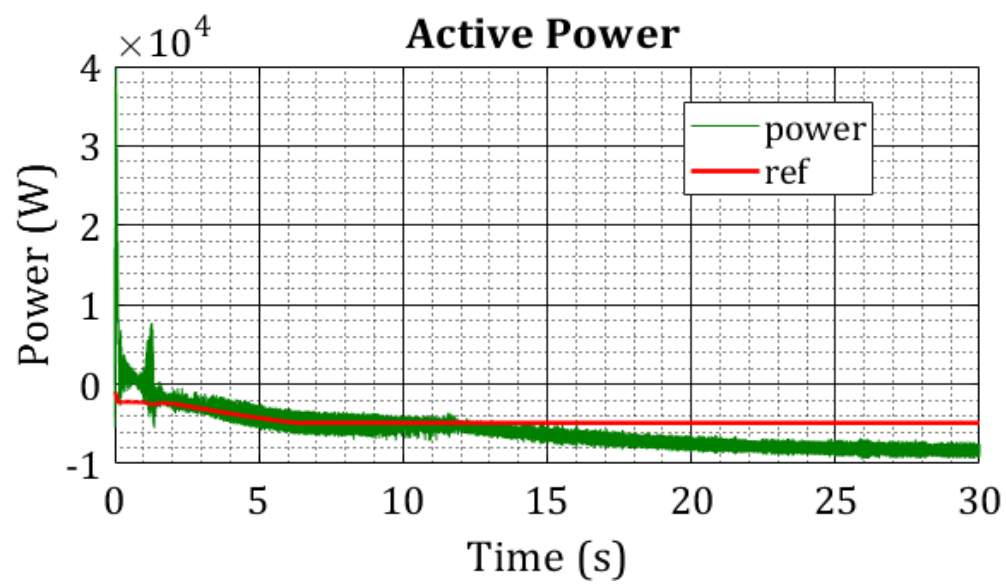


Fig. 8. (d) Active power

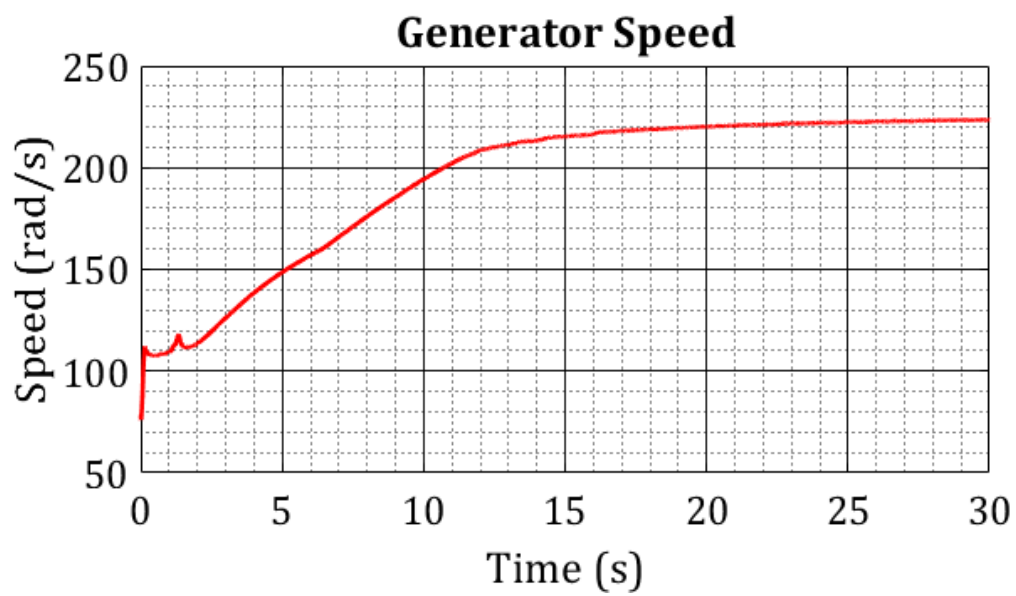


Fig. 8. (e) Generator speed

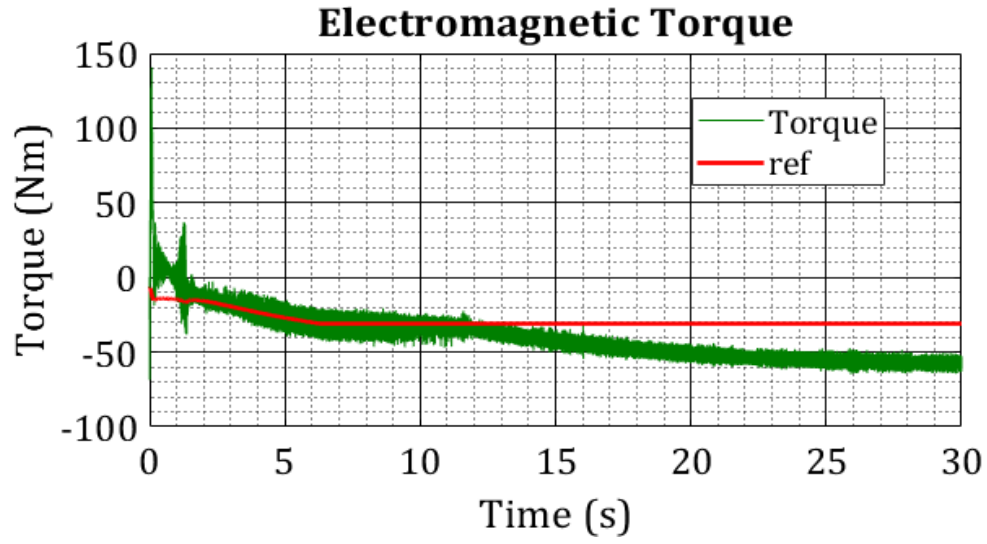


Fig. 8. (f) Electromagnetic torque

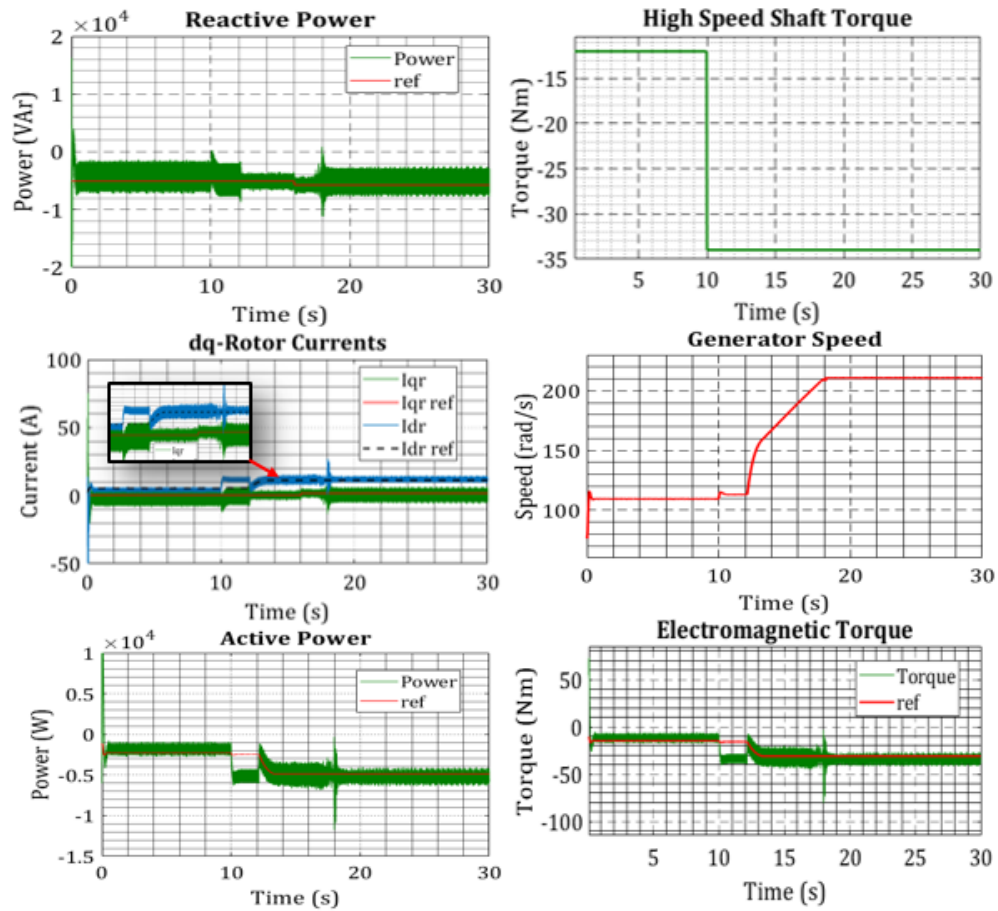


Fig. 10 Tracking performance of PI controller

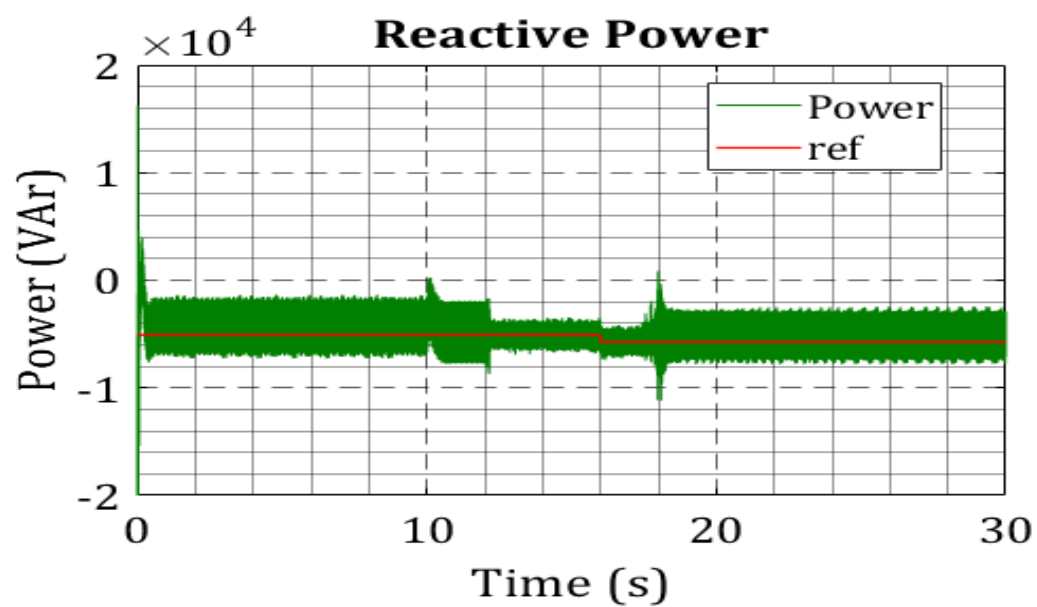


Fig. 10. (a) Reactive power

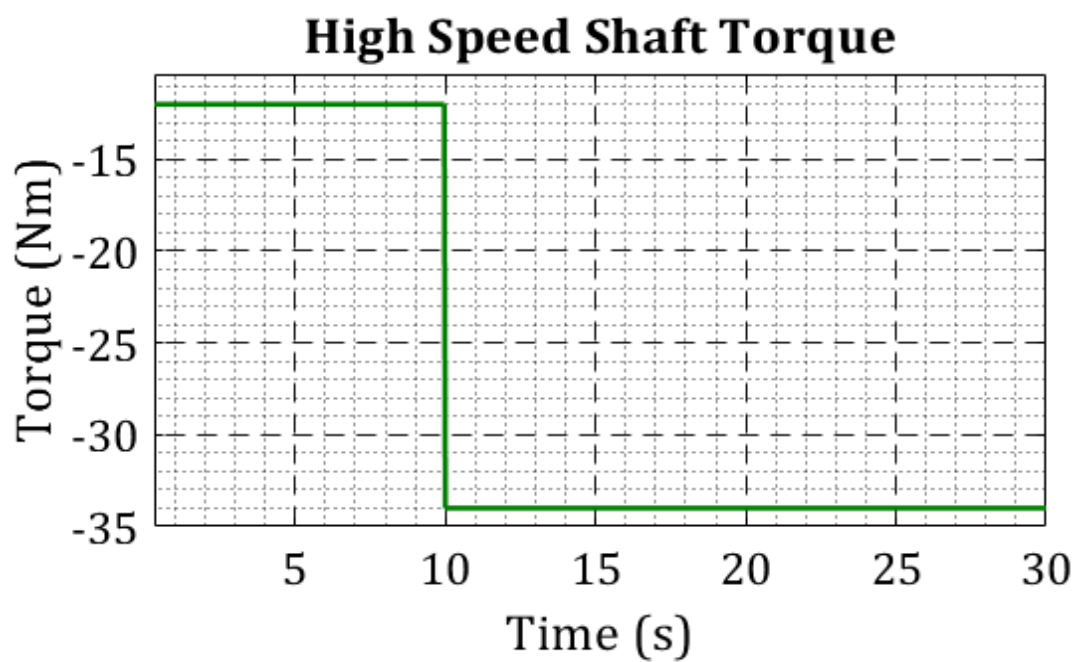


Fig. 10. (b) High speed shaft torque

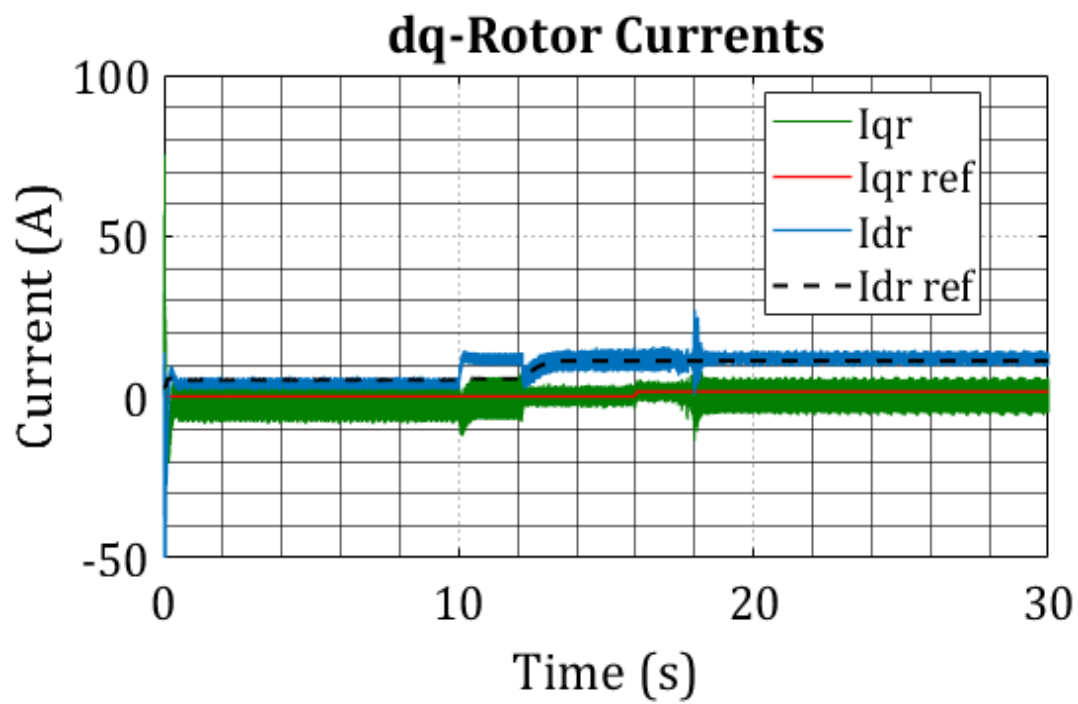


Fig. 10. (c) d-q rotor currents

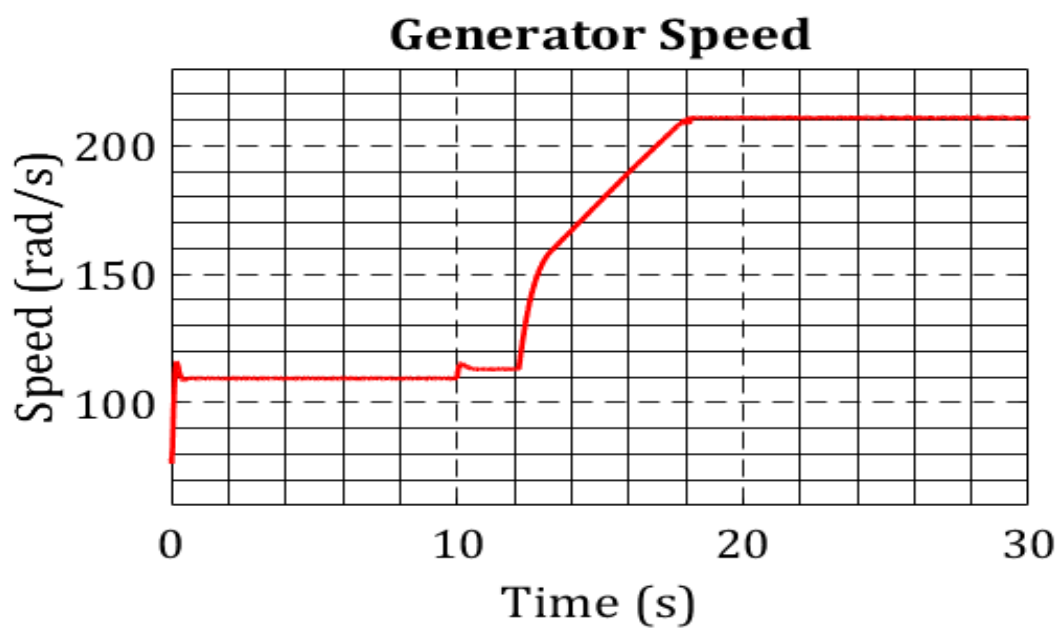


Fig. 10. (d) Generator speed

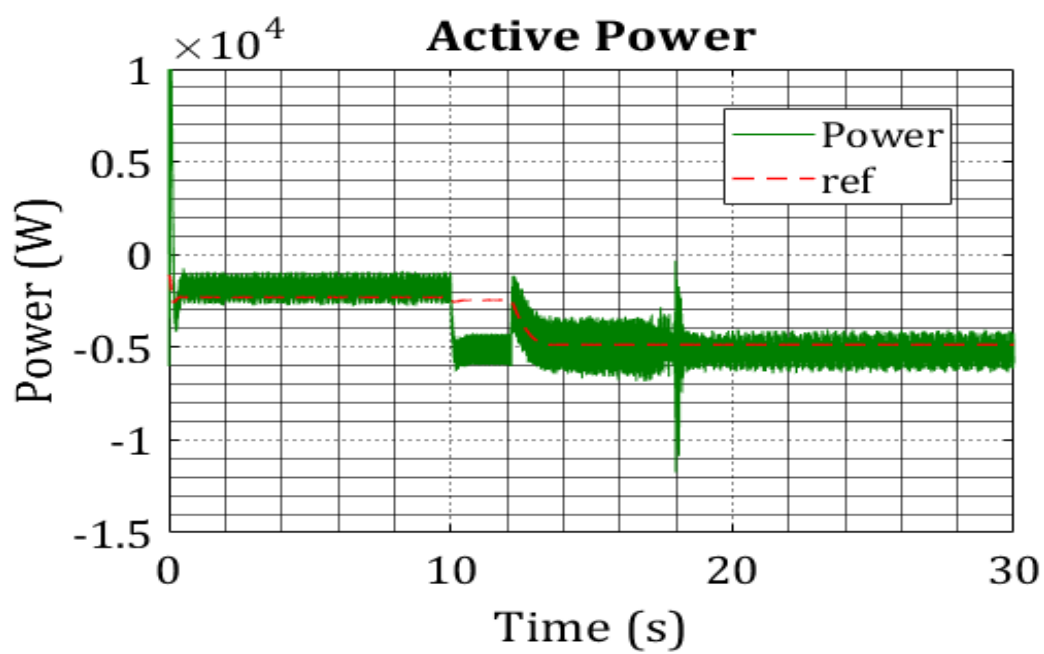


Fig. 10. (e) Active power

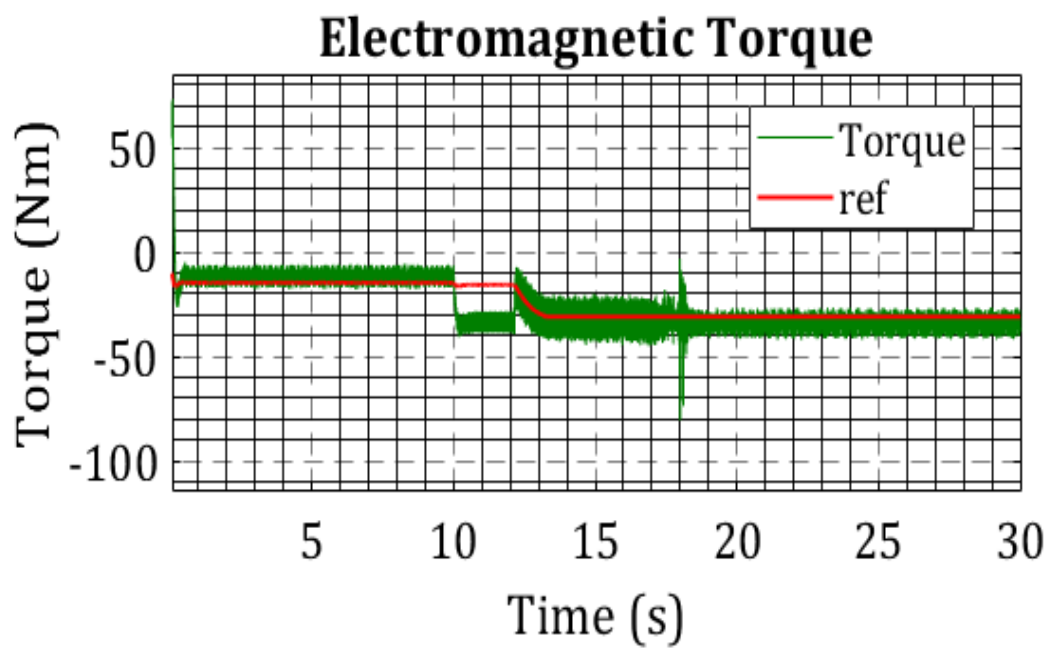


Fig. 10. (f) Electromagnetic torque

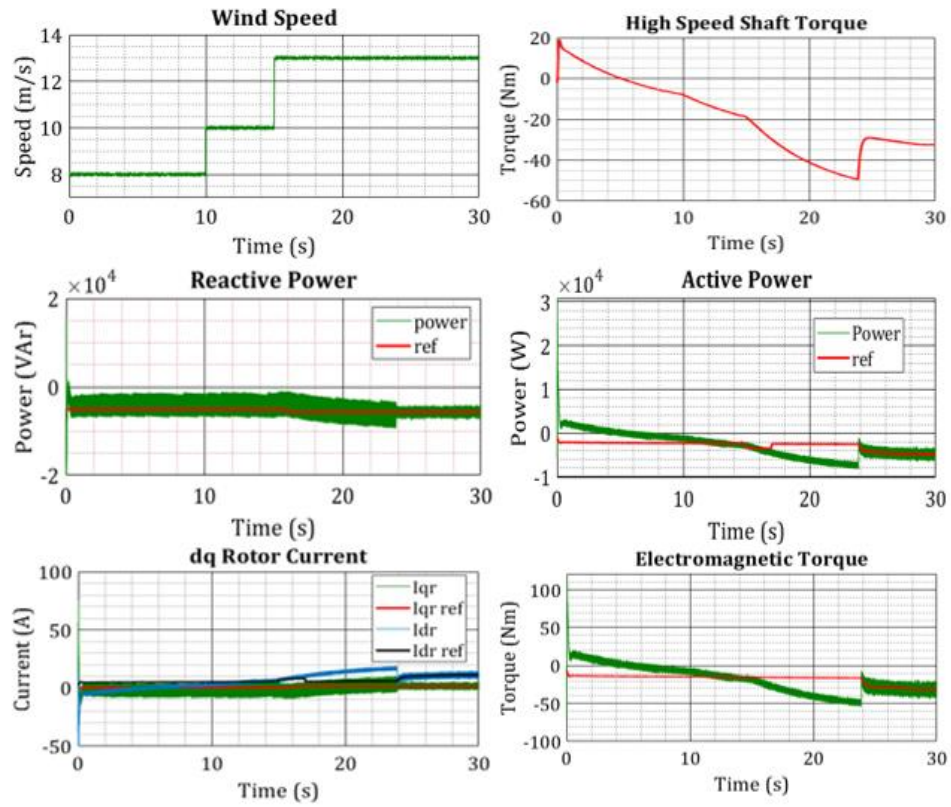


Fig. 11 Response of the PI controller to start-up conditions of the VAWT

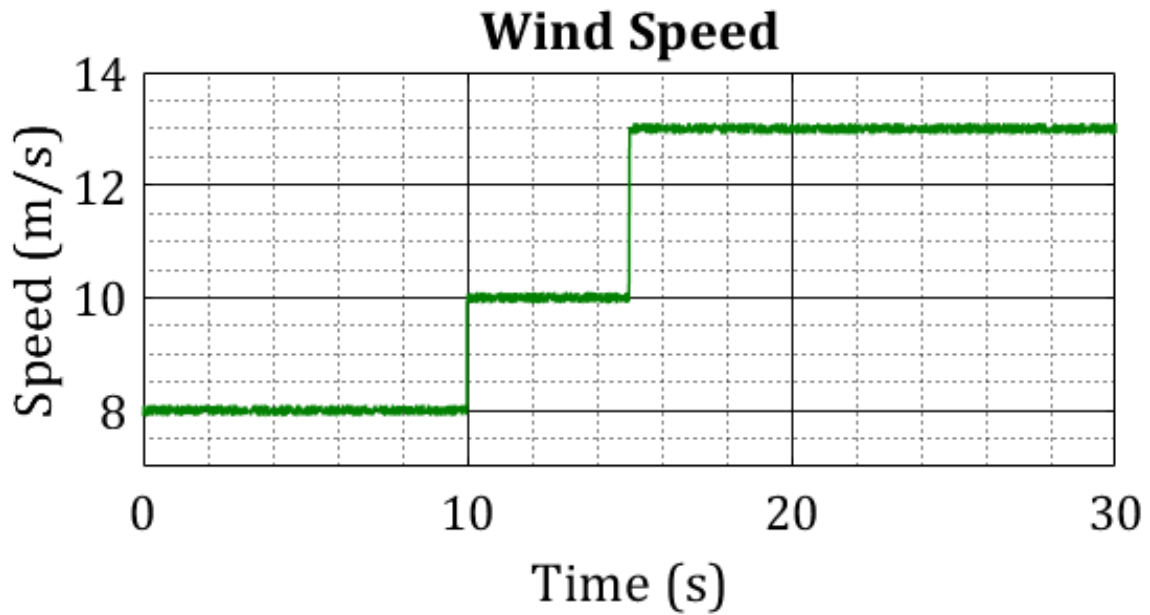


Fig. 11. (a) Wind speed

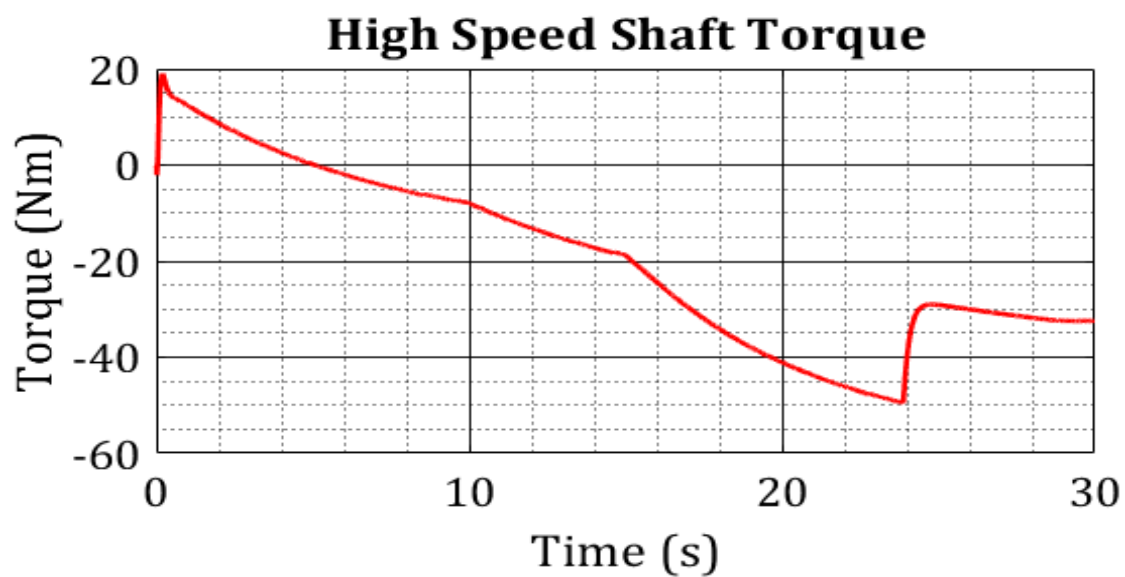


Fig. 11. (b) High speed shaft torque

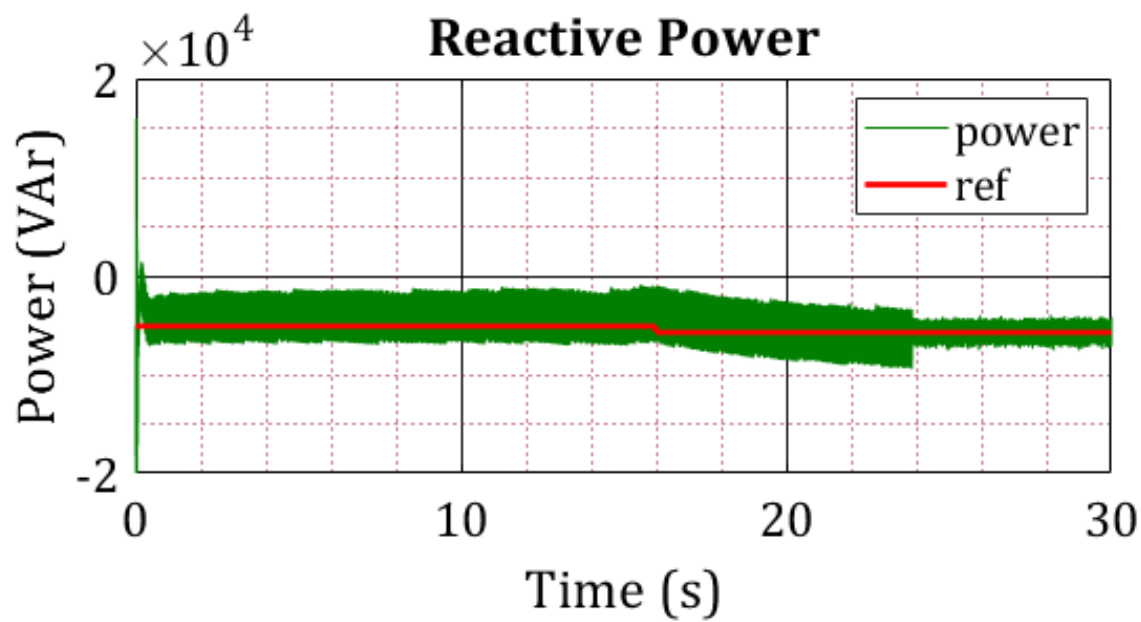


Fig. 11. (c) Reactive power

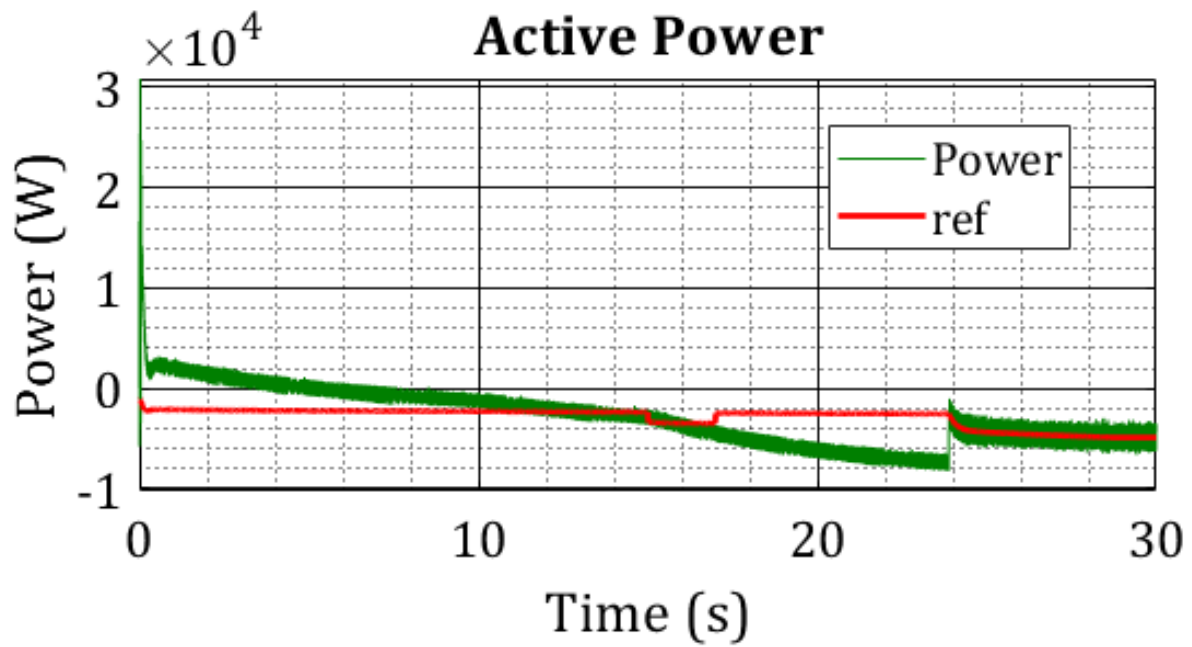


Fig. 11. (d) Active power

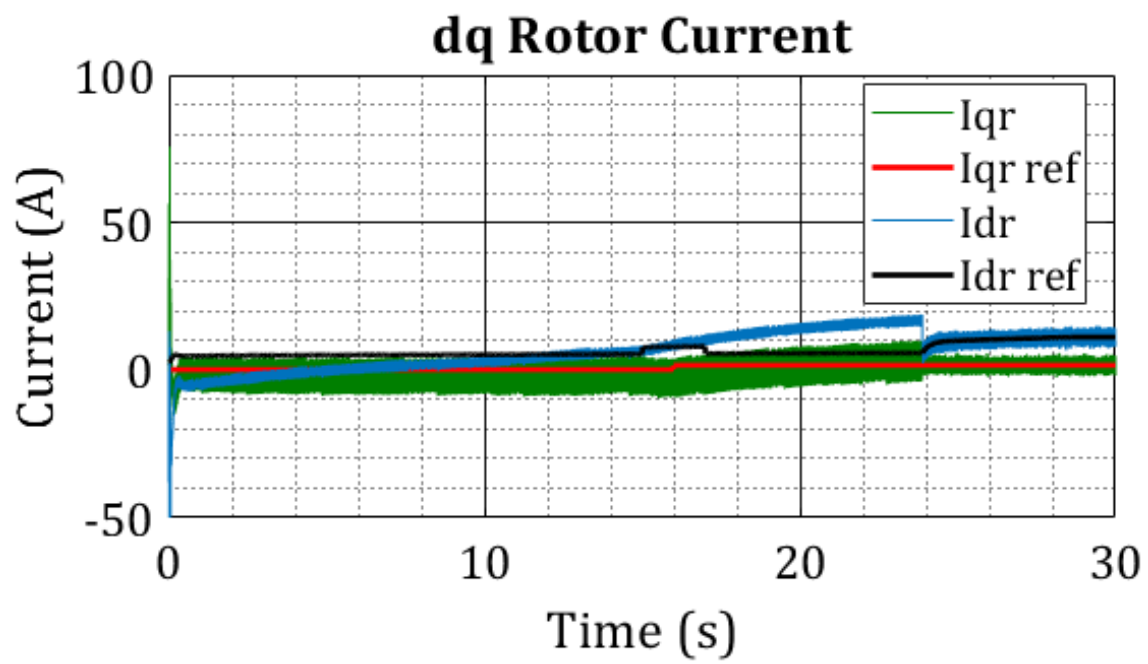
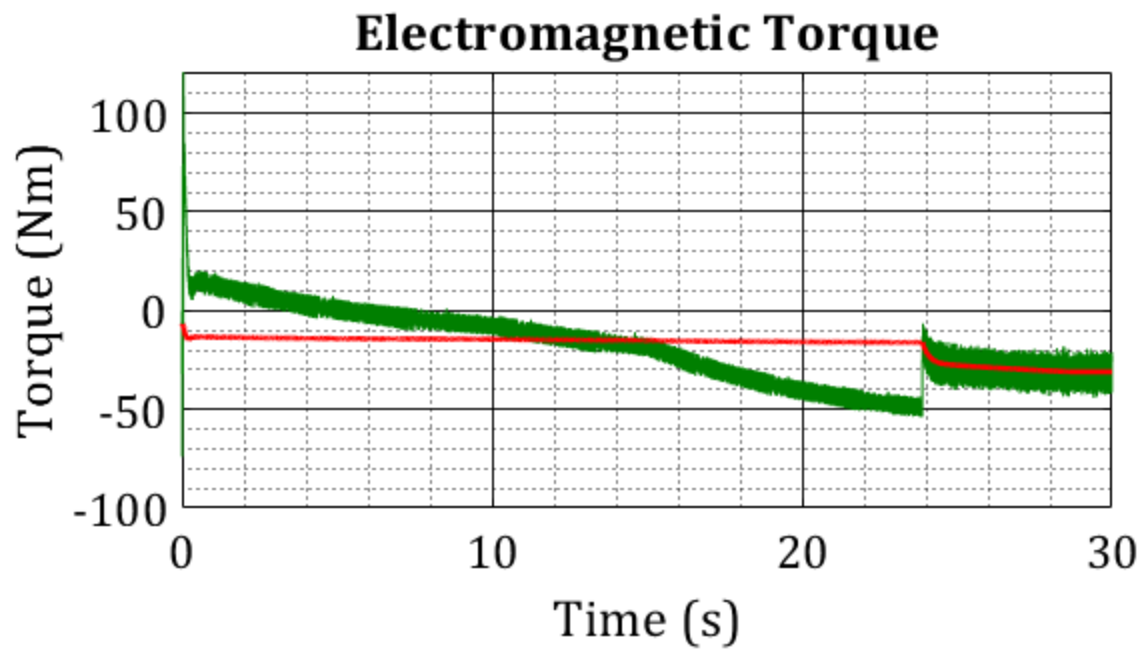


Fig. 11. (e) d-q rotor current



*Fig. 11. (f) Electromagnetic torque*