initial conditions for the generator variables and the estimates were fixed to $\delta(0) = 0.8$, $\omega(0) = 0.1$, $E'_q(0) = 0.8$, $\hat{\delta}(0) = 0.79$, $\hat{\omega}(0) = 0.0$ and $\hat{E}'_q(0) = 0.8$. Figures 1-3 show that the estimates given by the observer converge to the state of the system in open-loop.

In Figures 4, the performance of the observer-controller scheme is shown, where the initial conditions of the system were fixed as : $\delta(0) = 0.77$, $\omega(0) = 0.1$, $E'_q(0) = 0.85$. From this plot, we can see that the power angle converge to the desired reference.

6. Conclusions

In this paper a discrete-time nonlinear controller-observer scheme has been developed and applied to the continuous-time model of a synchronous generator. A tracking control was designed for the generator using the sliding-mode technique. Furthermore, an observer was designed to estimate the internal voltage and the angular speed, assuming that the power angle is available. Simulations results have shown the good performance of the observer-controller scheme.

Acknowledgments

This research was supported in part by PAICYT CA767-02 and the CONACYT-CNRS within the French-Mexican Laboratory of Automatic Control (LAFMAA).

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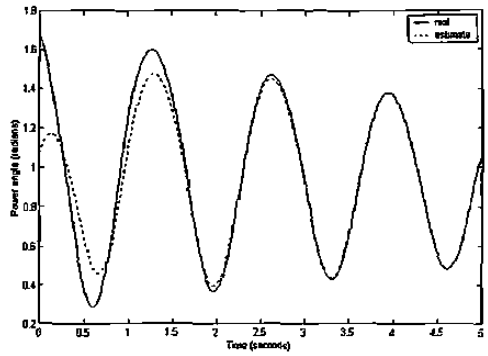

Figure 1. Power angle and its estimate.

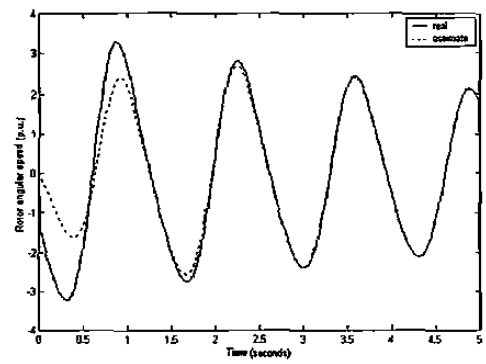

Figure 2. Rotor angular speed and its estimate.

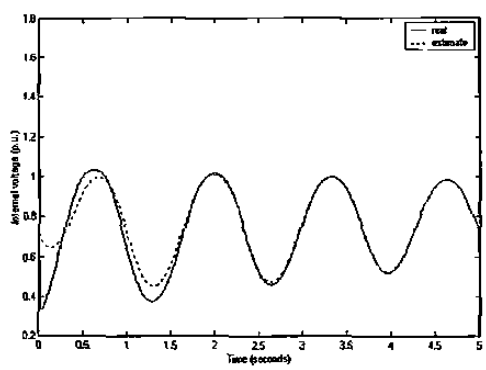

Figure 3. The internal voltage and its estimate.

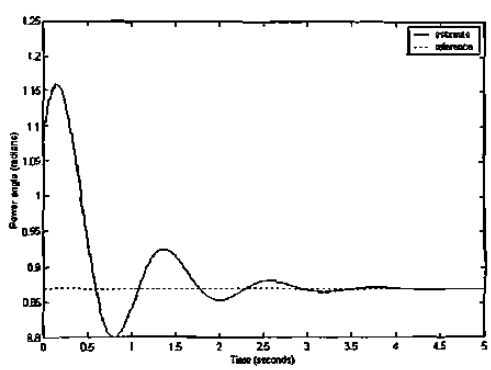

Figure 4. Response of the power angle.