Neural network-based supertwisting control for floating wind turbine in region III

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Résumé

A hybrid control strategy based on the super-twisting sliding mode approach and artificial neural network method is proposed for collective blade pitch (CBP) control of floating wind turbines (FWT) above the rated wind speed. Besides the presence of uncertainties and external disturbances due to the complexity of the model of wind turbines, the radial basis function (RBF) neural network is used to approximate model uncertainties and unmodeled dynamics, reducing the controller dependency on the exact model of the system. The implemented neural network adaptive law has been achieved based on the Lyapunov stability, and the convergence of the closed-loop system is guaranteed by adjusting the learning rate. As the floating wind turbine is a highly nonlinear system, the main objectives are limitation of platform pitch motion and related fatigues, blade fatigue load reduction, and power regulation. Using the FAST simulator, the proposed controller has been tested by achieving the required dynamic and static performance and the simulation results illustrate the efficiency of the investigated strategy by comparing it with and without the RBF neural network on the FWT.

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