

## **A HIGH GAIN ADAPTIVE OBSERVER DESIGN AN OVERVIEW**

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**Abstract.** The adaptive observer design has become a wide and active research field as pointed out by the fundamental contributions devoted to the challenging simultaneous estimation problem of the state variables as well as the unknown parameters. Several adaptive observers have been proposed and appropriately used in many challenging engineering problems, namely the parameter estimation, the design of adaptive control systems and supervision purposes. The main motivation of this presentation is to provide a comprehensive overview on the high gain adaptive observer design with a particular emphasis on the available fundamental results and their engineering perspectives. The presentation will be performed in three parts ended by pertinent remarks and promising perspectives.

- The first part will be dedicated to the rationale behind the adaptive observer design research activity and the formulation of the underlying problem with a particular attention to the considered class of systems and its relevance to the system engineering.
- The second part is mainly concerned with the high gain state observer design in the case where all parameters involved in the system are known. The underlying observer is used to address the problem of accurately estimating the mechanical and magnetic state variables of induction motors using only the stator current measurement and the supplied stator voltages using a judicious compilation of available fundamental results together with those useful safe implementation features, namely reduced and singularities free computational burden.
- The adaptive observer design is carried out in the third part while pointing out its main issues, namely the persistent excitation requirement and the exponential convergence. Simulation results involving an accurate estimation of the mechanical and magnetic state variables as well as the stator and rotor resistances of induction motors using only the stator current measurements and the supplied stator voltages are used to show the effectiveness of the proposed adaptive observer.
- The fourth part shows that the convergence results are recovered when the output measurements are available only at sampling instants up to an appropriate condition on the sampling process.

**Keywords.** Nonlinear system, High gain observer, High gain state feedback, Characteristic indices, Adaptive observer, Persistent excitation, Nonlinear parametrization. Illustrative examples