Abstract

Marwa A Abdel Hamid

Nonlinear and sampled data control with application to power systems

Sampled data systems have come into practical importance for a variety of reasons. The earliest of these had primarily to do with the economy of design. A more recent surge of interest was due to increase utilization of digital computers as controllers in feedback systems. This thesis contributes some control design for a class of nonlinear system exhibition linear output. The solution of several nonlinear control problems required the cancellation of some intrinsic dynamics (so-called zero dynamics) of the plant under feedback. It results that the so-defined control will ensure stability in closed-loop if and only if the dynamics to cancel are stable. What if those dynamics are unstable? Classical control strategies through inversion might solve the problem while making the closed-loop system unstable. This thesis aims to introduce a solution for such a problem. The main idea behind our work is to stabilize the non-minimum phase system in continuous-time and under-sampling using zero dynamics concept. The overall work in this thesis is divided into two parts. In Part I, we introduce a feedback control designs for the input-output stabilization and the Disturbance Decoupling problems of Single Input Single Output nonlinear systems. A case study is presented, to illustrate an engineering application of results. Part II illustrates the results obtained based on Artificial Intelligent Systems in power system machines. We note that even though the use of some of the AI techniques such as Fuzzy Logic and Neural Network does not require the computation of the model of the application, but it will still suffer from some drawbacks especially regarding the implementation in practical applications. An alternative used approach is to use control techniques such as PID in the approximated linear model. This design is very well known to be used, but it does not take into account the non-linearity of the model. In fact, it seems that control design that is based on nonlinear control provides better performances.