Discontinuous Pole Assignment Control of Uncertain Linear Systems Using Only Input/Output Measurements

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INTRODUCTION

The evolution of research activity concerning the model reference adaptive approach to the control of uncertain linear SISO systems has led to the design of a control structure for systems in input-output form with relative degree greater than one by introducing an augmented error signal, and to the solution of the complex stability problem associated with it [8], [10].

The set of assumptions concerning the plant uncertainty on which the classical adaptive schemes are based are: (i) knowledge of the sign of the high frequency gain; (ii) knowledge of the relative degree; (iii) knowledge of an upperbound on the order of the plant; (iv) location of all the zeros of the plant in $\mathbb{C}^-$ (complex open l.h.p.); (v) absence of disturbances.

The relaxation of assumptions ii), iii), and v) characterized a further phase in the evolution of this approach as demonstrated by the works by Ioannou and Kokotovic [7] about systems with unmodelled dynamics and by Peterson and Narendra [11] about systems affected by bounded disturbances. The results of this phase consisted mainly in the reduction of the control objectives to the attainment of bounded tracking errors and in a modification of the adaptation mechanism, in order to avoid pathological behaviours (e.g., bursting phenomena) [6]. This activity has produced results that may appear to be less effective than those obtainable by introducing the relevant concepts of the theory of discontinuous control [4], [13] in the context of adaptive control. Indeed, most authors in this area have recently steered to the VSS approach