Abstract

Some attempts using high frequency periodic feedback controllers have been made in literature to overcome the limitation of LTI controllers in respect of robust compensation for plants having right half plane (rhp) poles and zeros. These attempts are all found to use a particular controller configuration only. Although, it can achieve improvement in robustness (via loop zero-placement), it is found that the step responses of systems compensated such contain periodic oscillations of $O(1)$ magnitude. In this thesis first a new controller configuration has been proposed which, in addition to achieving robustness (via zero-placement), ensures that the oscillations become of magnitude $O(1/\omega^r)$ only, where ω is the frequency of the periodic gains of the controller and r is the relative order of the plant. Although the same has not been noticed in literature, it is next shown that such high frequency periodic controllers have the capability of achieving simultaneous pole-placement/stabilization of two plants which, as is well known, LTI controllers can not achieve in general. An enhancement of the above controller by introducing a set of higher order periodic terms is next proposed and it is shown that this controller can achieve not merely pole-placement but *robust* pole-placement of two plants simultaneously (via simultaneous pole and zero-placements). Further, the enhanced controller is employed to achieve simultaneous pole-placement/stabilization of even three plants. Finally, it is argued that further enhancement of such high frequency periodic controllers may not be possible.

Key words: Continuous-time periodic feedback control, Robust stabilization, Model matching, Simultaneous pole-placement/stabilization.