

Analysis of the Error in an Iterative Algorithm for the Solution of the Regulator Problems for Linear Distributed Parameter Control Systems

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ABSTRACT. The regulator equations are a coupled pair of operator equations that arise in the geometric approach to regulation in systems and control. The primary regulator problems of interest in this work involve asymptotic tracking and disturbance rejection for linear parabolic distributed parameter systems. Underlying our approach to solving problems of this type is the geometric regulation method in which control laws are obtained by solving a pair of regulator equations. In general it is not easy to solve the regulator equations or even obtain accurate numerical solutions. Furthermore, our main results apply to tracking and disturbance rejection for very general smooth bounded reference and disturbance signals. In this paper we present the β -iteration method for obtaining approximate solutions of the dynamic regulator equations for a class of infinite dimensional linear control systems. A major advantage of this theory compared to previous work is that an explicit error analysis is available for each step in the iteration. In particular, the geometric convergence of the β -iteration error can be controlled by changing β . We demonstrate our estimates on a variety of control problems in multi-physics applications.