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RECURSIVE COMPUTATION OF PARETO OPTIMAL STRATEGY FOR MULTIPARAMETER SINGULARLY PERTURBED SYSTEMS

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Abstract. In this paper, we study the Pareto optimal strategy for multiparameter singularly perturbed system (MSPS). In order to obtain the solution, we must solve the multiparameter algebraic Riccati equations (MARE). The main results in this paper are to propose a new recursive algorithm for solving the MARE and to find sufficient conditions regarding the convergence of our proposed algorithm. Using the recursive algorithm, we show that the solution of the MARE converges to a positive semi-definite stabilizing solution with the rate of convergence of $O(\|\mu\|^{i+1})$ under the sufficient conditions. Furthermore, we also show that the near-optimal strategy achieves the cost functional $J_j^* + O(\|\mu\|^{i+1})$.
Keywords. multiparameter singularly perturbed system (MSPS), multiparameter algebraic Riccati equations (MARE), Pareto optimal strategy, recursive algorithm, Pareto near-optimal strategy.
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1 Introduction

Multimodeling stability, control and filtering problems have been investigated extensively (see e.g., [1-4,8-10,14]). The multimodeling problems arise in large scale dynamic systems. For example, these multimodel situations in practice are illustrated by the multi-area power system [8] and the passenger car model [2]. In order to obtain the optimal solution to the multimodeling problems, we must solve the multiparameter algebraic Riccati equation (MARE), which is parameterized by two small positive parameters ε_1 and ε_2 of the same order. Various reliable approaches to the theory of the algebraic Riccati equation (ARE) have been well documented in the literature (see e.g., [6,11]). One of the approaches is the invariant subspace approach which is based on the Hamiltonian matrix [11]. However, such an approach is not adequate to the multiparameter singularly perturbed systems (MSPS) since