Dynamics of Continuous, Discrete and Impulsive Systems
Series **B:** *Applications & Algorithms* **24 (2017)** 335-370

DISCRETE SINGULARLY PERTURBED CONTROL PROBLEMS (A SURVEY)

G. A. Kurina[1,2], M. G. Dmitriev[2,3], and D. S. Naidu[4]

[1] Mathematical Department, Voronezh State University
and Economical Department, Institute of Law and Economics, Voronezh, Russia

[2] Federal Research Center "Computer Science and Control"
of Russian Academy of Sciences, Moscow, Russia

[3]National Research University - Higher School of Economics, Moscow, Russia

[4] Department of Electrical Engineering, University of Minnesota Duluth,
Duluth, MN 55812-3009, USA

This paper is dedicated to A. B. Vasil'eva.

Abstract. The paper presents the review of various types of discrete singularly perturbed control problems and methods for solving them. The bibliography containing 157 titles is included.

Keywords. Discrete optimal control problems, nonlinear and linear-quadratic problems, singular perturbations, weakly controllable systems, asymptotic expansions, motions decomposition, stabilization, game problems, stochastic systems, systems with a small step, descriptor systems.

AMS (MOS) subject classification: 93C55, 93C70.

1 Introduction

Many problems from applied sciences lead to dynamical systems, where the state space variables have certain components which vary rapidly, and other which vary relatively slowly in time. Usually, such problems are studied within the framework of singular perturbations and integral manifolds. We will consider the singularity in a broad sense as the change of some qualitative characteristics of a perturbed problem if a small parameter equals zero.

The most part of publications devoted to singularly perturbed control problems deals with continuous systems while a lot of problems in economics, sociology, biology is described by discrete models. The another source of