Solving mixed optimal control problems using a feed forward neural network model

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Abstract

This paper gives a survey of the various forms of Pontryagins maximum principle for optimal control problems with state variable inequality constraints. Furthermore, the application of these maximum principle conditions is demonstrated by solving one illustrative example.

Keywords: optimal control, maximum principles, state constraints, control constraints, mixed constraints
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1 Introduction

Optimal control problems with state variable inequality constraints (SVICs) arise frequently not only in mechanics and aerospace engineering, but also in the areas of management science and economics.
This paper gives a survey of the various forms of the maximum principle for deterministic continuous-time optimal control problems with SVICs and explains the connection between these approaches; see also Hartl[1], [2], Hartl and Sethi [3], and Arutyunov [1] for earlier such attempts.

2 Problem statement and transformation

Let us consider the following optimal control problem with state constraints:

$$\text{maximize} \qquad \int_0^T F(x(t), u(t), t)\, dt + S(x(T), T), \tag{1}$$

subject to

$$\dot{x}(t) = f(x(t), u(t), t), \qquad x(0) = x_0, \tag{2}$$

$$g(x(t), u(t), t) \geq 0, \tag{3}$$

$$h(x(t), t) \geq 0, \tag{4}$$

$$a(x(T), T) \geq 0, \tag{5}$$

$$b(x(T), T) = 0. \tag{6}$$

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