

Chapter 2

Calculus of Variations and Optimal Control

Solution to Problem 2.1

The performance index is

$$\begin{aligned} J &= \int_0^2 [2x^2(t) + \dot{x}^2(t)] dt, \\ &= \int_{t_0}^{t_f} V(x(t), \dot{x}(t)) dt \end{aligned}$$

where

$$V = 2x^2(t) + \dot{x}^2(t), \quad t_0 = 0, \quad t_f = 2.$$

Using the Euler-Lagrange equation (2.3.15)

$$\begin{aligned} \left(\frac{\partial V}{\partial x} \right)_* - \frac{d}{dt} \left(\frac{\partial V}{\partial \dot{x}} \right)_* &= 0 \longrightarrow \\ 4x^*(t) - \frac{d}{dt} (2\dot{x}^*(t)) &= 0 \longrightarrow \\ \ddot{x}^*(t) - 2x^*(t) &= 0. \end{aligned}$$

Solving the previous equation

$$x^*(t) = C_1 e^{\sqrt{2}t} + C_2 e^{-\sqrt{2}t}$$

Optimal Control Systems Naidu Solution Manual

S Ben Porath

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Optimal Control Systems D. Subbaram Naidu,2002-08-27 The theory of optimal control systems has grown and flourished since the 1960 s Many texts written on varying levels of sophistication have been published on the subject Yet even those purportedly designed for beginners in the field are often riddled with complex theorems and many treatments fail to include topics that are essential to a thorough grounding in the various aspects of and approaches to optimal control Optimal Control Systems provides a comprehensive but accessible treatment of the subject with just the right degree of mathematical rigor to be complete but practical It provides a solid bridge between traditional optimization using the calculus of variations and what is called modern optimal control It also treats both continuous time and discrete time optimal control systems giving students a firm grasp on both methods Among this book s most outstanding features is a summary table that accompanies each topic or problem and includes a statement of the problem with a step by step solution Students will also gain valuable experience in using industry standard MATLAB and SIMULINK software including the Control System and Symbolic Math Toolboxes Diverse applications across fields from power engineering to medicine make a foundation in optimal control systems an essential part of an engineer s background This clear streamlined presentation is ideal for a graduate level course on control systems and as a quick reference for working engineers [Solutions Manual for Optimal Control Systems](#) Laurie Kelly,2004-02

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