. Record Nr. Autore	UNINA9910483576203321 Glizer Valery Y.
Titolo	Controllability of singularly perturbed linear time delay systems / / Valery Y. Glizer
Pubbl/distr/stampa	Cham, Switzerland : , : Birkhauser, , [2021] ©2021
ISBN	3-030-65951-8
Descrizione fisica	1 online resource (429 pages)
Collana	Systems and Control: Foundations and Applications
Disciplina	003.74
Soggetti	Linear systems Control theory Sistemes lineals Teoria de control Llibres electrònics
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Intro Contents 1 Introduction 1.1 Real-Life Models 1.1.1 Neurosystem Model 1.1.2 Sunflower Equation 1.1.3 Model of Nuclear Reactor Dynamics 1.1.4 Model of Controlled Coupled-Core Nuclear Reactor 1.1.5 Car-Following Model: Lane as a Simple Open Curve 1.1.6 Car-Following Model: Lane as a Simple Closed Curve References 2 Singularly Perturbed Linear Time Delay Systems 2.1 Introduction 2.2 Singularly Perturbed Systems with Small Delays 2.2.1 Original System 2.2.2 Slow-Fast Decomposition of the Original System 2.2.3 Fundamental Matrix Solution 2.2.4 Estimates of Solutions to Singularly Perturbed Matrix Differential Systems with Small Delays 2.2.5 Example 1 2.2.6 Example 2: Tracking Model with Delay 2.2.7 Example 3: Analysis of Neurosystem Model 2.2.8 Example 4: Analysis of Sunflower Equation 2.2.9 Proof of Lemma 2.2 2.2.10 Proof of Theorem 2.1 2.3 Singularly Perturbed Systems with Delays of Two Scales 2.3.1 Original System 2.3.2 Slow-Fast Decomposition of the Original System 2.3.3 Fundamental Matrix Solution 2.3.4 Estimates of Solutions to Singularly Perturbed Matrix

1.

Differential Systems with Delays of Two Scales -- 2.3.5 Example 5 --2.3.6 Example 6: Dynamics of Nuclear Reactor -- 2.3.7 Example 7: Analysis of Car-Following Model in a Simple Closed Lane -- 2.3.8 Proof of Theorem 2.2 -- 2.4 One Class of Singularly Perturbed Systems with NonsmallDelays -- 2.4.1 Original System -- 2.4.2 Slow-Fast Decomposition of the Original System -- 2.4.3 Fundamental Matrix Solution -- 2.4.4 Estimates of Solutions to Singularly Perturbed Matrix Differential Systems with Nonsmall Delays -- 2.4.5 Example 8 -- 2.4.6 Proof of Lemma 2.4 -- 2.4.7 Proof of Theorem 2.4 -- 2.5 Concluding Remarks and Literature Review. References -- 3 Euclidean Space Output Controllability of Linear Systems with State Delays -- 3.1 Introduction -- 3.2 Systems with Small Delays: Main Notions and Definitions -- 3.2.1 Original System --3.2.2 Asymptotic Decomposition of the Original System -- 3.3 Auxiliary Results -- 3.3.1 Output Controllability of a System with State Delays: Necessary and Sufficient Conditions -- 3.3.2 Linear Control Transformation in Systems with Small Delays -- 3.3.2.1 Control Transformation in the Original System -- 3.3.2.2 Asymptotic Decomposition of the Transformed System (3.30)-(3.31), (3.3) -- 3.3.3 Hybrid Set of Riccati-Type Matrix Equations -- 3.3.4 Proof of Lemma 3.1 -- 3.3.4.1 Sufficiency -- 3.3.4.2 Necessity -- 3.3.5 Proof of Lemma 3.5 -- 3.3.6 Proof of Lemma 3.7 -- 3.3.7 Proof of Lemma 3.8 -- 3.3.8 Proof of Lemma 3.9 -- 3.4 Parameter-Free Controllability Conditions for Systems with Small Delays -- 3.4.1 Case of the Standard System (3.1)-(3.2) -- 3.4.2 Case of the Nonstandard System (3.1)-(3.2) --3.4.3 Proofs of Theorems 3.1, 3.2, and 3.3 -- 3.4.3.1 Proof of Theorem 3.1 -- 3.4.3.2 Proof of Theorem 3.2 -- 3.4.3.3 Proof of Theorem 3.3 -- 3.5 Special Cases of Controllability for Systems with Small Delays --3.5.1 Complete Euclidean Space Controllability -- 3.5.2 Controllability with Respect to x(t) - 3.5.3 Controllability with Respect to y(t) - 3.6Examples: Systems with Small Delays -- 3.6.1 Example 1 -- 3.6.2 Example 2 -- 3.6.3 Example 3 -- 3.6.4 Example 4 -- 3.6.5 Example 5 -- 3.6.6 Example 6: Pursuit-Evasion Engagement with Constant Speeds of Participants -- 3.6.7 Example 7: Pursuit-Evasion Engagement with Variable Speeds of Participants -- 3.6.8 Example 8: Analysis of Controlled Coupled-Core Nuclear Reactor Model -- 3.7 Systems with Delays of Two Scales: Main Notionsand Definitions -- 3.7.1 Original System.

3.7.2 Asymptotic Decomposition of the Original System -- 3.8 Linear Control Transformation in Systems with Delays of Two Scales -- 3.8.1 Control Transformation in the Original System -- 3.8.2 Asymptotic Decomposition of the Transformed System (3.196)-(3.197), (3.187) --3.9 Parameter-Free Controllability Conditions for Systems with Delays of Two Scales -- 3.9.1 Case of the Validity of the Assumption (AIII) --3.9.2 Case of the Validity of the Assumption (AIV) -- 3.9.3 Special Cases of Controllability -- 3.9.3.1 Complete Euclidean Space Controllability -- 3.9.3.2 Controllability with Respect to x(t) -- 3.9.3.3 Controllability with Respect to y(t) -- 3.9.4 Example 9 -- 3.9.5 Example 10 -- 3.9.6 Example 11: Controlled Car-Following Model in a Simple Open Lane -- 3.10 Concluding Remarks and Literature Review --References -- 4 Complete Euclidean Space Controllability of Linear Systems with State and Control Delays -- 4.1 Introduction -- 4.2 System with Small State Delays: Main Notions and Definitions -- 4.2.1 Original System -- 4.2.2 Asymptotic Decomposition of the Original System -- 4.3 Preliminary Results -- 4.3.1 Auxiliary System with Small State Delays and Delay-Free Control -- 4.3.2 Output Controllability of the Auxiliary System and Its Slow and Fast Subsystems: Necessary and Sufficient Conditions -- 4.3.2.1 Equivalent Forms of the Auxiliary

System -- 4.3.2.2 Output Controllability of the Auxiliary System --4.3.2.3 Output Controllability of the Slow and Fast Subsystems Associated with the Auxiliary System -- 4.3.3 Linear Control Transformation in the Original System with Small State Delays -- 4.3.4 Stabilizability of a Parameter-Dependent System with State and Control Delays by a Memory-Less Feedback Control -- 4.3.5 Proof of Lemma 4.8 -- 4.4 Parameter-Free Controllability Conditions for Systems with Small State Delays.

4.4.1 Case of the Standard System (4.1)-(4.2) -- 4.4.2 Case of the Nonstandard System (4.1)-(4.2) -- 4.4.3 Proof of Main Lemma (Lemma 4.9) -- 4.4.3.1 Auxiliary Propositions -- 4.4.3.2 Main Part of the Proof -- 4.4.4 Alternative Approach to Controllability Analysis of the Nonstandard System (4.1)-(4.2) -- 4.4.4.1 Linear Control Transformation in the Auxiliary System (4.40)-(4.42) -- 4.4.4.2 Proof of Lemma 4.10 -- 4.4.4.3 Hybrid Set of Riccati-Type Matrix Equations -- 4.4.4.4 Parameter-Free Controllability Conditions of the Nonstandard System (4.1)-(4.2) -- 4.5 Examples: Systems with Small State and Control Delays -- 4.5.1 Example 1 -- 4.5.2 Example 2 --4.5.3 Example 3 -- 4.6 Systems with State Delays of Two Scales: Main Notions and Definitions -- 4.6.1 Original System -- 4.6.2 Asymptotic Decomposition of the Original System -- 4.7 Auxiliary System with State Delays of Two Scales and Delay-Free Control -- 4.7.1 Description of the Auxiliary System and Some of Its Properties -- 4.7.2 Asymptotic Decomposition of the Auxiliary System (4.180)-(4.181) -- 4.7.3 Linear Control Transformation in the Auxiliary System (4.180)-(4.181) -- 4.8 Parameter-Free Controllability Conditions for Systems with Delays of Two Scales -- 4.8.1 Case of the Validity of the Assumption (AV) --4.8.2 Case of the Validity of the Assumption (AVI) -- 4.8.3 Example 4 -- 4.8.4 Example 5 -- 4.8.5 Example 6: Analysis of Car-Following Model with State and Control Delays -- 4.9 Concluding Remarks and Literature Review -- References -- 5 First-Order Euclidean Space Controllability Conditions for Linear Systems with Small State Delays --5.1 Introduction -- 5.2 Singularly Perturbed System: Main Notions and Definitions -- 5.2.1 Original System -- 5.2.2 Asymptotic Decomposition of the Original System -- 5.3 Auxiliary Results. 5.3.1 Estimates of Solutions to Some Singularly Perturbed Linear Time Delay Matrix Differential Equations -- 5.3.2 Proof of Lemma 5.1 --5.3.2.1 Technical Proposition -- 5.3.2.2 Main Part of the Proof -- 5.3.3 Complete Controllability of the Original System and Its Slow Subsystem: Necessarv and SufficientConditions -- 5.4 Parameter-Free Controllability Conditions -- 5.4.1 Formulation of Main Assertions --5.4.2 Proof of Theorem 5.1 -- 5.4.3 Proof of Lemma 5.2 -- 5.4.4 Proof of Theorem 5.2 -- 5.4.4.1 Euclidean Space Controllability of a Pure Fast System -- 5.4.4.2 Main Part of the Proof -- 5.5 Examples -- 5.5.1 Example 1 -- 5.5.2 Example 2 -- 5.5.3 Example 3 -- 5.5.4 Example 4 -- 5.5.5 Example 5 -- 5.5.6 Example 6 -- 5.5.7 Example 7: Analysis of Controlled Car-Following Model in a Simple Open Lane -- 5.6 Concluding Remarks and Literature Review -- References -- 6 Miscellanies -- 6.1 Introduction -- 6.2 Euclidean Space Controllability of Linear Time Delay Systems with High Gain Control -- 6.2.1 High Gain Control System: Main Notionsand Definitions -- 6.2.1.1 Initial System -- 6.2.1.2 Transformation of the System (6.1) -- 6.2.2 High Dimension Controllability Condition for the System (6.5) -- 6.2.3 Asymptotic Decomposition of the System (6.5) -- 6.2.4 Auxiliary Results -- 6.2.4.1 Linear Control Transformation in the System (6.13) -(6.14) and Some of its Properties -- 6.2.4.2 Asymptotic Decomposition of the Transformed System (6.13), (6.21) -- 6.2.4.3 Block-Wise Estimate of the Solution to the Terminal-Value Problem

(6.23) -- 6.2.5 Lower Dimension Parameter-Free Controllability
Condition for the System (6.5) -- 6.2.6 Example -- 6.3 Euclidean Space
Controllability of Linear Systems with Nonsmall Input Delay -- 6.3.1
Original System -- 6.3.2 Discussion on the Slow-Fast Decomposition of
the Original System -- 6.3.3 Auxiliary Results.
6.3.3.1 Necessary and Sufficient Controllability Conditions of the
Original System.