

References

1. Alessandri, A., Baglietto, M., Battistelli, G.: On estimation error bounds for receding-horizon filters using quadratic boundedness. *IEEE Transactions on Automatic Control* 49, 1350–1355 (2004)
2. Alessandri, A., Cervellera, C., Grassia, A.F., Sanguineti, M.: An approximate solution to optimal L_p state estimation problems. In: *Proceedings of the American Control Conference*, pp. 4204–4209 (2005)
3. Acikmese, A.B., Corless, M.: Observers for systems with nonlinearities satisfying an incremental quadratic inequality. In: *Proceedings of the American Control Conference*, Portland, OR, USA, pp. 3622–3629 (2005)
4. Aslund, J., Frisk, E.: An observer for non-linear differential-algebraic systems. *Automatica* 42, 959–965 (2006)
5. Arcak, M., Kokotovic, P.: Nonlinear observers: a circle criterion design and robustness analysis. *Automatica* 37, 1923–1930 (2001)
6. Arcak, M., Kokotovic, P.: Observer-based control of systems with slope-restricted nonlinearities. *IEEE Transactions on Automatic Control* 46, 1146–1150 (2001)
7. Arcak, M., Teel, A.: Input-to-state stability for a class of Lurie systems. *Automatica* 38, 1945–1949 (2002)
8. Assawinchaichote, W., Nguang, S.K.: H_∞ fuzzy control design for nonlinear singularly perturbed systems with pole placement constraints: an LMI approach. *IEEE Transactions on Systems, Man and Cybernetics, Part B: Cybernetics* 34, 579–588 (2004)
9. Assawinchaichote, W., Nguang, S.K.: Fuzzy H_∞ output feedback control design for singularly perturbed systems with pole placement constraints: an LMI approach. *IEEE Transactions on Fuzzy Systems* 14, 361–371 (2006)
10. Ayasun, S., Nwankpa, C.O., Kwatny, H.G.: Computation of singular and singularity induced bifurcation points of differential-algebraic power system model. *IEEE Transactions on Circuits and Systems-I: Regular Papers* 51, 1525–1538 (2004)
11. Assawinchaichote, W., Nguang, S.K., Shi, P.: H_∞ output feedback control design for uncertain fuzzy singularly perturbed systems: an LMI approach. *Automatica* 40, 2147–2152 (2004)
12. Alvarez-Gallegos, J., Silva-Navarro, G.: Two-time scale sliding-mode control for a class of nonlinear systems. *International Journal of Robust and Nonlinear Control* 7(9), 865–879 (1997)
13. Beardmore, R.E.: The singularity-induced bifurcation and its kronecker normal form. *SIAM Journal of Matrix Analysis and Applications* 23, 126–137 (2001)

14. Boutayeb, M., Darouach, M.: Observers design for nonlinear descriptor systems. In: Proceedings of the IEEE Conference on Decision and Control, pp. 2369–2374 (1995)
15. Brenan, K.E., Campbell, S., Petzold, L.R.: Numerical Solution of Initial-Value Problems in Differential-Algebraic Equations. SIAM, Philadelphia (1996)
16. Bruin, J., Doris, A., Wouw, N., Heemels, W., Nijmeijer, H.: Control of mechanical motion systems with non-collocation of actuation and friction: A Popov criterion approach for input-to-state stability and set-valued nonlinearities. *Automatica* 45, 405–415 (2009)
17. Boyd, S., Ghaoui, L.E., Feron, E., Balakrishnan, V.: Linear Matrix Inequalities in System and Control Theory. SIAM, Philadelphia (1994)
18. Bender, D.J., Laub, A.J.: The linear-quadratic optimal regulator for descriptor systems. *IEEE Transactions on Automatic Control* 32, 672–688 (1987)
19. Boshang, C., Xiaoxin, L., Yongqing, L.: Normal Forms and Bifurcations for the Differential-Algebraic Systems. *Acta Mathematicae Applicatae Sinica* 23, 429–443 (2000) (in Chinese)
20. Chang, K.: Singular perturbations of a general boundary value problem. *SIAM Journal on Mathematical Analysis* 3, 520–526 (1972)
21. Campbell, S.: Singular Systems of Differential Equations. Pitman, London (1980)
22. Cobb, D.: Controllability, observability and duality in singular systems. *IEEE Transactions on Automatic Control* 29, 1076–1082 (1984)
23. Clark, C.W.: Mathematical Bioeconomics: the Optimal Management of Renewable Resources. Wiley, New York (1990)
24. Chu, D.: Disturbance decoupled observer design for linear time-invariant systems: a matrix pencil approach. *IEEE Transactions on Automatic Control* 45, 1569–1575 (2000)
25. Chen, C.T.: The Meaning and Properties of Singular Systems. *Journal of Guangdong Institute For Nationalities* 4, 1–8 (2001) (in Chinese)
26. Chen, C.T.: Stability of large-scale nonlinear singular dynamical systems. *Dynamics of Continuous, Discrete and Impulsive Systems Series B: Applications and Algorithm Supp.* SI, pp. 203–212 (2003)
27. Chiou, J.S., Kung, F.C., Li, T.H.S.: An infinite ε -bound stabilization design for a class of singularly perturbed systems. *IEEE Transactions on Circuits and Systems I: Fundamental Theory and Applications* 46, 1507–1510 (1999)
28. Chen, S.J., Lin, J.L.: Maximal stability bounds of singularly perturbed systems. *Journal of the Franklin Institute* 336, 1209–1218 (1999)
29. Cao, Y., Lin, Z.: A descriptor system approach to robust stability analysis and controller synthesis. *IEEE Transactions on Automatic Control* 49, 2081–2084 (2004)
30. Chu, D., Mehrmann, V.: Disturbance decoupled observer design for descriptor systems. *Systems & Control Letters* 38, 37–48 (1999)
31. Campbell, S.L., Nichol, N., Terrell, W.J.: Duality, observability and controllability for time-varying descriptor systems. *Circuits, Systems and Signal Processing* 10, 455–470 (1991)
32. Cao, S.G., Rees, N.W., Feng, G.: Analysis and design for a class of complex control systems Part I: fuzzy modelling and identification. *Automatica* 33, 1017–1028 (1997)
33. Cao, S.G., Rees, N.W., Feng, G.: Analysis and design for a class of complex control systems Part II: fuzzy controller design. *Automatica* 33, 1029–1039 (1997)
34. Chen, X.L., Shayman, M.A.: Dynamics and control of constrained nonlinear systems with application to robotics. In: Proceedings of the American Control Conference, pp. 2962–2966 (1992)

35. Cao, L., Schwartz, H.M.: Complementary results on the stability bounds of singularly perturbed systems. *IEEE Transactions on Automatic Control* 49, 2017–2021 (2004)
36. Choi, H.L., Shin, Y.S., Lim, J.T.: Control of nonlinear singularly perturbed systems using feedback linearisation. *Proceedings–Control Theory and Applications* 152, 91–94 (2005)
37. Campbell, S.L., Terrell, W.J.: Obserability for linear time-varying descriptor systems. *SIAM Journal on Matrix Analysis and Applications* 12, 484–496 (1991)
38. Chen, B.S., Tseng, C.S., Uang, H.J.: Mixed H_2/H_∞ fuzzy output feedback control design for nonlinear dynamic systems: an LMI approach. *IEEE Transactions on Fuzzy Systems* 8, 249–265 (2000)
39. Dai, L.: *Singular Control Systems*. Springer, Berlin (1989)
40. Dragan, V.: Asymptotic expansions for game-theoretic Riccati equations and stabilization with disturbance attenuation for singularly perturbed systems. *Systems & Control Letters* 126, 455–463 (1993)
41. Derbel, N.: Suboptimal control of linear singularly perturbed systems. In: *Proceedings of International Conference on Control Applications*, pp. 1035–1040 (1995)
42. Darouach, M., Boutayeb, M.: Design of observers for descriptor systems. *IEEE Transactions on Automatic Control* 40, 1323–1327 (1995)
43. Debeljkovic, D.L., Kablar, N.A.: Finite-time stability of linear singular systems: Bellman-Gronwall approach. In: *Proceeding of the American Control Conference*, pp. 1803–1806 (1999)
44. Deng, Z., Liu, Y.: Descriptor Kalman estimators. *International Journal of Systems Science* 30, 1205–1212 (1999)
45. Debeljkovic, D.L., Owens, D.H.: On practical stability of singular systems. In: *Proceedings of Melecon 1985: Mediterranean Electrochemical Conference*, pp. 103–105 (1985)
46. Darouach, M., Zasadzinski, M., Hayar, M.: Reduced-order observer design for descriptor systems with unknown inputs. *IEEE Transactions on Automatic Control* 41, 1068–1072 (1996)
47. Darouach, M., Zasadzinski, M., Mehdi, D.: State estimation of stochastic singular linear systems. *International Journal of Systems Science* 24, 345–354 (1993)
48. Dong, X.Z., Zhang, Q.L.: Robust passive control for singular systems with time-varying uncertainties. *Control Theory and Applications* 21, 517–520 (2004) (in Chinese)
49. Dong, X.Z., Zhang, Q.L.: Robust strictly dissipative control for linear singular systems. *Control and Decision* 20, 195–198 (2005) (in Chinese)
50. El Ghaoui, L., Niculescu, S.: *Advances in Linear Matrix Inequality Methods in Control*. SIAM, Philadelphia (2000)
51. Feng, W.: Characterization and computation for the bound ϵ^* in linear time-invariant singularly perturbed systems. *Systems & Control Letters* 11, 195–202 (1988)
52. Fridman, E.: Near-optimal H_∞ control of linear singularly perturbed systems. *IEEE Transactions on Automatic Control* 41, 236–240 (1996)
53. Fridman, E.: A descriptor system approach to nonlinear singularly perturbed optimal control problem. *Automatica* 37, 543–549 (2001)
54. Fridman, E.: State-feedback H_∞ control of nonlinear singularly perturbed systems. *International Journal of Robust Nonlinear Control* 11, 1115–1125 (2001)
55. Fan, X., Arcak, M.: Observer design for systems with multivariable monotone nonlinearities. *Systems & Control Letters* 50, 319–330 (2003)
56. Fang, C.H., Chang, F.R.: Analysis of stability robustness for generalized state-space systems with structured perturbation. *Systems & Control Letters* 21, 109–114 (1993)

57. Feng, Z., Deng, F., Liu, Y.: Practical stability of uncertain linear control systems. *Control Theory and Applications* 14, 623–628 (1997)
58. Fletcher, L.R., Kautely, J., Nichols, N.K.: Eigenstructure assignment in descriptor systems. *IEEE Transactions on Automatic Control* 31, 1138–1141 (1986)
59. Fang, C.H., Lee, L.: Robustness of regional pole placement for uncertain continuous-time implicit systems. *IEEE Transactions on Automatic Control* 39, 2303–2307 (1994)
60. Fahmy, M.M., O'Reilly, J.: Observers for descriptor systems. *International Journal of Control* 49, 2013–2028 (1989)
61. Feng, J., Wu, Z., Sun, J.: Finite-time control of linear singular systems with parametric uncertainties and disturbances. *ACTA Automatica Sinica* 31, 634–637 (2005)
62. George, C.V., Bernard, C.L., Thomas, K.: A generalized state-space for singular systems. *IEEE Transactions on Automatic Control* 26, 811–831 (1981)
63. Garcia, G., Daafouz, J., Bernussou, J.: A LMI solution in the H_2 optimal problem for singularly perturbed systems. In: *Proceedings of the American Control Conference*, pp. 550–554 (1998)
64. Geromel, J.C., Gapski, P.B.: Synthesis of positive real H_2 controllers. *IEEE Transactions on Automatic Control* 42, 988–992 (1997)
65. Gao, Z., Ho, D.W.C.: State/noise estimator for descriptor systems with application to sensor fault diagnosis. *IEEE Transactions on Signal Processing* 54, 1316–1326 (2006)
66. Gahinet, P., Nemirovski, A., Laub, A.J., Chilali, M.: *LMI Control Toolbox for Use with Matlab*. The Mathworks Inc., Natic (1995)
67. Gao, Y., Lu, G., Wang, Z.: Passivity Analysis of Uncertain Singularly Perturbed Systems. *IEEE Trans. Circuits Syst. II: Express Briefs* 57, 486–490 (2010)
68. Guan, Y., Saif, M.: A novel approach to the design of unknown input observers. *IEEE Transactions on Automatic Control* 36, 632–635 (1991)
69. Huang, C.P.: Stability analysis of discrete singular fuzzy systems. *Fuzzy Sets and Systems* 151, 155–165 (2005)
70. Hao, F.: Full-order observer design for descriptor systems with delayed state and unknown inputs. In: *Chinese Control Conference*, pp. 765–770 (2006)
71. Haddad, W., Bernstein, D.: Explicit construction of quadratic Lyapunov functions for the small gain, positivity, circle and Popov theorems and their application to robust stability Part I: continuous-time theory. *International Journal of Robust Nonlinear Control* 3, 313–339 (1993)
72. Haddad, W., Bernstein, D.: Explicit construction of quadratic Lyapunov functions for the small gain, positivity, circle and Popov theorems and their application to robust stability Part II: discrete-time theory. *International Journal of Robust Nonlinear Control* 4(2), 249–265 (1994)
73. Haddad, W.M., Bemstein, D.S.: Parameter-dependent Lyapunov functions and the Popov criterion in robust analysis and synthesis. *IEEE Transactions on Automatic Control* 40, 536–543 (1995)
74. Huang, C.H., Ioannou, P.A., Safonov, M.G.: Design of strictly positive real systems using constant output feedback. *IEEE Transactions on Automatic Control* 44, 569–573 (1999)
75. Huang, S., James, M.R., Nescic, D., Dower, P.M.: A unified approach to controller design for achieving ISS and related properties. *IEEE Transactions on Automatic Control* 50, 1681–1697 (2005)
76. Hsiung, K., Lee, L.: Lyapunov inequality and bounded real lemma for discrete-time descriptor systems. *IEE Proceedings-Control Theory and Applications* 146, 327–331 (1999)

77. Hou, M., Muller, P.V.: Design of observers for linear systems with unknown inputs. *IEEE Transactions on Automatic Control* 37, 871–875 (1992)
78. Hou, M., Muller, P.C.: Observer design for descriptor systems. *IEEE Transactions on Automatic Control* 44, 164–169 (1999)
79. Haibin, S., Xiaoli, Z., Siying, Z., Xiaoping, L.: Design of Derivative-output Feedback Robust Controllere for a class of Similar Generalized Interconnected Systems. *Information and Control* 30, 224–230 (2001)
80. Haohui, L., Yun, T.: The Voltage Stability of a DAE Model for Singlemachine Infinite Bus System. *Automation of Electric Power Systems* 24, 11–15 (2000) (in Chinese)
81. Hu, T., Goebel, R., Teel, A., Lin, Z.: Conjugate Lyapunov functions for saturated linear systems. *Automatica* 41, 1949–1956 (2005)
82. Ioannou, P.A.: Robustness of absolute stability. *International Journal Control* 34, 1027–1033 (1981)
83. Ishihara, J., Terra, M.: On the Lyapunov theorem for singular systems. *IEEE Transactions on Automatic Control* 47, 1926–1930 (2002)
84. Jia, X.C., Zheng, N.N.: Impulse-free Robustness and Wide-range Impulse Robust Control of Generalized Uncertain Systems. *Information and Control* 30, 7–10 (2001) (in Chinese)
85. Jing, X., Zhang, Q.L.: Design of positive real state feedback control for continuous-time descriptor systems based on LMI. *Control and Decision* 19, 281–284 (2004) (in Chinese)
86. Khalil, H.K.: Asymptotic stability of nonlinear multiparameter singularly perturbed systems. *Automatica* 17, 797–804 (1981)
87. Khalil, H.K.: *Nonlinear Systems*, 3rd edn. Prentice Hall (1996)
88. Koenig, D.: Unknown input proportional multiple-integral observer design for linear descriptor systems: application to state and fault estimation. *IEEE Transactions on Automatic Control* 50(2), 212–217 (2005)
89. Koenig, D.: Observer design for unknown input nonlinear descriptor systems via convex optimization. *IEEE Transactions on Automatic Control* 51, 1047–1052 (2006)
90. Kecman, V., Bingulac, S., Gajic, Z.: Eigenvector approach for order reduction of singularly perturbed linear quadratic optimal control problems. *Automatica* 35, 151–158 (1999)
91. Kablar, N.A., Debeljkovic, D.L.: Finite-Time Stability of Time-Varying Linear Singular Systems. In: *Proceedings of IEEE on Conference on Decision and Control*, pp. 3831–3836 (1998)
92. Kablar, N.A., Debeljkovic, D.L.: Finite-time instability of time-varying linear singular system. In: *Proceedings of the American Control Conference*, pp. 1796–1800 (1999)
93. Kecman, V., Gajic, Z.: Optimal control and filtering for nonstandard singularly perturbed linear systems. *Journal of Guidance, Control and Dynamics* 22, 362–365 (1999)
94. Konishi, K., Kokame, H.: Robust stability of Lur’e systems with time-varying uncertainties: a linear matrix inequality approach. *International Journal of Systems Science* 30, 3–9 (1999)
95. Krishnan, H., McClamroch, N.H.: Tracking in nonlinear differential-algebraic control systems with applications to constrained robot systems. *Automatica* 30, 1885–1897 (1994)
96. Koenig, D., Mammar, S.: Design of proportional-integral observer for unknown input descriptor systems. *IEEE Transactions on Automatic Control* 47, 2057–2062 (2002)
97. Koenig, D., Marx, B.: Observer design with H_∞ performance for delay descriptor systems. In: *Proceedings of the American Control Conference*, pp. 5129–5134 (2007)

98. Khorasani, K., Pai, M.A.: Asymptotic stability of nonlinear singularly perturbed systems using higher order corrections. *Automatica* 21, 717–727 (1985)
99. Kawaji, S., Taha, E.Z.: Feedback linearization of a class of nonlinear descriptor systems. In: *Proceedings of the IEEE Conference on Decision and Control*, pp. 4035–4037 (1994)
100. Kokotovic, P.V., Yacel, R.A.: Singular perturbation of linear regulators: basic theorems. *IEEE Transactions on Automatic Control* 17, 29–37 (1972)
101. La Salle, L.S.: *Stability by Lyapunov's Direct Method*. Academic Press, New York (1961)
102. Luenberger, D.G.: Dynamic equation in descriptor form. *IEEE Transactions on Automatic Control* 22(3), 310–319 (1977)
103. Luenberger, D.G.: Time-invariant descriptor systems. *Automatica* 14, 473–480 (1978)
104. Lewis, F.: A survey of linear singular systems. *Circuits, Systems and Signal Processing* 5, 3–36 (1986)
105. Lewis, F.: A tutorial on the geometric analysis of linear time-invariant implicit systems. *Automatica* 28, 119–137 (1992)
106. Lin, Q.: *Passive Analysis and Control Problem for a Class of Singular Systems*. Ph.D Thesis, Northeastern University, Shenyang (2007) (in Chinese)
107. Liao, X.: *Absolute Stability of Nonlinear Control Systems*. Science Press, Beijing (1993)
108. Liu, H.P., Sun, F.C., He, K.Z., Sun, Z.Q.: Survey of singularly perturbed control systems: theory and applications. *Control Theory and Applications* 20, 1–7 (2003) (in Chinese)
109. Liu, X.P.: On linearization of nonlinear singular control systems. In: *Proceedings of the American Control Conference*, pp. 2284–2287 (1993)
110. Liu, X.P.: Solvability of nonlinear singular systems: Part I, the case without inputs. In: *Proceedings of the American Control Conference*, pp. 2257–2261 (1995)
111. Liu, X.P.: Solvability of nonlinear singular systems: Part II, the case with inputs. In: *Proceedings of the American Control Conference*, pp. 2262–2266 (1995)
112. Liu, X.P.: Robust stabilization of nonlinear singular systems. In: *Proceedings of the IEEE Conference on Decision and Control*, pp. 2375–2376 (1995)
113. Liu, X.P.: Disturbance decoupling for affine nonlinear singular control systems. In: *Proceedings of the 13th IFAC World Congress*, pp. 239–244 (1996)
114. Liu, X.P.: Feedback control of affine nonlinear singular control systems. *International Journal of Control* 68, 753–774 (1997)
115. Liu, X.P.: Asymptotic output tracking of nonlinear differential-algebraic control systems. *Automatica* 34, 393–397 (1998)
116. Liu, C., Zhang, Q., Zhang, Y.: Bifurcation and control in a differential-algebraic harvested prey-predator model with stage structure for predator. *International Journal of Bifurcation and Chaos* 18, 3159–3168 (2008)
117. Li, Y.: Tractability and stability of nonlinear singular systems. In: *Dynamics of Continuous, Discrete and Impulsive Systems Series B: Applications and Algorithm* supp. SI, pp. 109–114 (2003)
118. Löfberg, L.: YALMIP: a toolbox for modeling and optimization in MATLAB. In: *Proceedings of the CACSD Conference*, pp. 284–289 (2004)
119. Lin, J.L., Chen, S.J.: Robust stability analysis of generalized interval systems using a structured singular value. *International Journal of Systems Science* 29, 199–206 (1998)
120. Lee, L., Chen, J.: Strictly positive real lemma and absolute stability for discrete-time descriptor systems. *IEEE Transactions on Circuits and Systems I: Fundamental Theory and Applications* 50, 788–794 (2003)

121. Lee, C.M., Fong, I.K.: H_∞ optimal singular and normal filter design for uncertain singular systems. *IET Control Theory and Applications* 1, 119–126 (2007)
122. Lu, G., Ho, D.W.C.: Generalized quadratic stabilization for discrete-time singular systems with time-delay and nonlinear perturbation. *Asian Journal of Control* 7, 211–222 (2005)
123. Lu, G., Ho, D.W.C.: Generalized quadratic stability for continuous-time singular systems with nonlinear perturbation. *IEEE Transactions on Automatic Control* 51, 818–823 (2006)
124. Lu, G., Ho, D.W.C.: Full-order and reduced-order observers for Lipschitz descriptor systems: the unified LMI approach. *IEEE Transactions on Circuits and Systems II: Express Briefs* 53, 563–567 (2006)
125. Lasalle, J., Lefschetz, S.: *Stability by Lyapunov Direct Method and Application*. Academic Press, New York (1961)
126. Li, T.H.S., Li, J.H.: Stabilization bound of discrete two-time-scale systems. *Systems & Control Letters* 18, 479–489 (1992)
127. Li, Y., Liu, Y.: Basic theory of singular systems of linear differential difference equations. In: *Proceedings of the 13th IFAC World Congress* vol. L, pp. 79–84 (1996)
128. Li, Y., Liu, Y.: Stability of solutions of singular systems with delay. *Control Theory and Applications* 15, 542–550 (1998)
129. Ling, K.V., Lim, K.W.: Receding horizon recursive state estimation. *IEEE Transactions on Automatic Control* 44, 1750–1753 (1999)
130. Li, T.H.S., Lin, K.J.: Stabilization of singularly perturbed fuzzy systems. *IEEE Transactions on Fuzzy Systems* 12, 579–595 (2004)
131. Li, T.H.S., Lin, K.J.: Composite fuzzy control of nonlinear singularly perturbed systems. *IEEE Transactions on Fuzzy Systems* 15, 176–187 (2007)
132. Lakshmikantham, V., Leela, S., Martynuk, A.A.: *Practical Stability of Nonlinear Systems*. World Scientific Press, Singapore (1990)
133. Lawrence, F.S., Mark, W.R., Jacek, A.K.: Solving index-1 DAEs in MATLAB and Simulink. *SIAM Review* 18, 538–552 (1999)
134. Lakshmikantham, V., Matrosov, V.M., Sivasundaram, S.: *Vector Lyapunov Functions and Stability Analysis of Nonlinear Systems*. Kluwer Academic Press, London (1991)
135. Liu, W.Q., Paskota, M., Sreeram, V., Teo, K.L.: Improvement on stability bounds for singularly perturbed systems via state feedback. *International Journal of Systems Science* 28, 571–578 (1996)
136. Liu, H., Sun, F., Hu, Y.: H_∞ control for fuzzy singularly perturbed systems. *Fuzzy Sets and Systems* 155, 272–291 (2005)
137. Liu, H., Sun, F., Sun, Z.: Stability analysis and synthesis of fuzzy singularly perturbed systems. *IEEE Transactions on Fuzzy Systems* 13, 273–284 (2005)
138. Liberzon, D., Sontag, E.D., Wang, Y.: Universal construction of feedback laws achieving ISS and integral-ISS disturbance attenuation. *Systems & Control Letters* 46, 111–127 (2002)
139. Lin, C., Wang, Q.G., Lee, T.H.: Stability and stabilization of a class of fuzzy time-delay descriptor systems. *IEEE Transactions on Fuzzy Systems* 14, 542–551 (2006)
140. Lu, G., Ho, D.W.C.: Generalized quadratic stability for continuous-time singular systems with nonlinear perturbation. *IEEE Transactions on Automatic Control* 51, 818–823 (2006)
141. Lu, G., Wang, D., Sun, Y.: Observer design for descriptor systems with Lipschitz constraint. In: *International Conference on Control and Automation*, pp. 220–223 (2005)

142. Lu, R.Q., Wang, J.H., Xue, A.K., Su, H.Y., Chu, J.: Robust H_∞ filtering for a class of uncertain Lurie time-delay singular systems. *Acta Automatica Sinica* 33, 292–296 (2007)
143. Li, Y., Wang, J.L., Yang, G.H.: Sub-optimal linear quadratic control for singularly perturbed systems. In: *Proceedings of the IEEE Conference on Decision and Control*, pp. 3698–3703 (2001)
144. Lin, C., Wang, J.L., Yang, G.H., Lam, J.: Robust stabilization via state feedback for descriptor systems with uncertainties in the derivative matrix. *International Journal of Control* 73, 407–415 (2000)
145. Lin, J.Y., Yang, Z.H.: Existence and uniqueness of solutions for nonlinear singular(descriptor) systems. *International Journal of Systems Sciences* 19, 2179–2184 (1988)
146. Liu, X., Zhang, Q.: Approaches to quadratic stability conditions and H_∞ control designs for T-S fuzzy systems. *IEEE Transactions on Fuzzy Systems* 11, 830–839 (2003)
147. Li, Y.Q., Wang, X.C.: *Variable Structure Control of Descriptor Systems*. South China University of Technology Press, Guang Zhou (1997) (in Chinese)
148. Liu, Y.Q., Guo, Y.S., Wu, J., Lu, G.W.: Bifurcation Phenomena and Structural Stability for Generalized Systems Against the Background of Electric Systems. *Journal of South China University of Technology (Natural Science)* 29, 87–90 (2001) (in Chinese)
149. McClamroch, N.H.: Feedback stabilization of control systems described by a class of nonlinear differential-algebraic equations. *Systems & Control Letters* 15, 53–60 (1990)
150. Mohler, R.: *Nonlinear Systems*. Prentice Hall, Englewood Cliffs (1991)
151. Mustafa, D.: Block Lyapunov sum with applications to integral controllability and maximal stability of singularly perturbed systems. *International Journal of Control* 61, 47–63 (1995)
152. Muller, P.: Linear mechanical descriptor systems: identification, analysis and design. In: *IFAC International Conference on Control of Industrial Systems*, pp. 501–506 (1997)
153. Masubuchi, I.: Dissipative inequalities for continuous-time descriptor systems with applications to synthesis of control gains. *Systems & Control Letters* 55, 158–164 (2006)
154. Masubuchi, I., Kamitane, Y., Ohara, A., Suda, N.: H_∞ control for descriptor systems: a matrix inequalities approach. *Automatica* 33, 669–673 (1997)
155. Mukaidani, H., Xu, H., Mizukami, K.: Recursive approach of H_∞ control problems for singularly perturbed systems under perfect and imperfect state measurements. *International Journal of Systems Science* 30, 467–477 (1999)
156. Martynyuk, A.A., Sun, Z.: *Practical Stability and Its Applications*. Science Press, Beijing (2003) (in Chinese)
157. Nikoukhah, R., Campbell, S.L., Delebecque, F.: Kalman filtering for general discrete-time linear systems. *IEEE Transactions on Automatic Control* 44, 1829–1839 (1999)
158. Narendra, K.S., Taylor, J.H.: *Frequency Domain Criteria for Absolute Stability*. Academic Press, New York (1973)
159. Nikoukhah, R., Willsky, A.S., Levy, B.C.: Kalman filtering and Riccati equations for descriptor systems. *IEEE Transactions on Automatic Control* 37, 1325–1342 (1992)
160. Park, P.: A revised Popov criterion for a system with multiple sector restrictions. *International Journal of Control* 68, 461–469 (1997)
161. Pan, Z., Basar, T.: H_∞ optimal control for singularly perturbed systems-Part I: perfect state measurements. *Automatica* 29, 401–423 (1993)
162. Pan, Z., Basar, T.: H_∞ optimal control for singularly perturbed systems-Part II: imperfect state measurements. *IEEE Transactions on Automatic Control* 39, 280–299 (1994)
163. Pan, Z., Basar, T.: Time-scale separation and robust controller design for uncertain nonlinear singularly perturbed systems under perfect state measurements. *International Journal of Robust Nonlinear Control* 6, 585–608 (1996)

164. Paraskevopoulos, P.N., Koumboulis, K.N.: Decoupling and pole assignment in generalized state space systems. *IEE Proceedings-Control Theory and Applications* 138, 547–560 (1991)
165. Rosenbrock, H.H.: Structure properties of linear dynamical systems. *International Journal of Control* 20, 191–202 (1974)
166. Rheinboldt, W.C.: On the existence and uniqueness of solutions of nonlinear semi-implicit differential-algebraic equations. *Nonlinear Analysis, Theory, Methods and Applications* 16, 642–661 (1991)
167. Riaza, R.: Singular bifurcations in higher index differential-algebraic equations. *Dynamical Systems* 17, 243–261 (2002)
168. Riaza, R.: Double SIB points in differential-algebraic systems. *IEEE Transactions on Automatic Control* 48, 1625–1629 (2003)
169. Rouchon, P., Fliess, M., Levine, J.: Kronecker's canonical forms for nonlinear implicit differential systems. In: *The 2nd IFAC Workshop on System Structure and Control*, pp. 248–251 (1992)
170. Renquan, L., Wenjun, H., Hongye, S., Jian, C.: Robust H_∞ Control for A Class of Uncertain Lurie Singular Systems with Time-Delays. *Acta Automatica Sinica* 30, 920–927 (2004) (in Chinese)
171. Sandell, N.R.: Robust stability of systems with application to singular perturbations. *Automatica* 15, 467–470 (1979)
172. Sontag, E.D.: Smooth stabilization implies coprime factorization. *IEEE Transactions on Automatic Control* 34, 435–443 (1989)
173. Shahruz, S.M.: Design of H_∞ optimal compensators for singularly perturbed systems. In: *Proceedings of the IEEE Conference on Decision and Control*, pp. 2397–2398 (1989)
174. Saydy, L.: New stability/performance results for singularly perturbed systems. *Automatica* 32, 807–818 (1996)
175. Shields, N.D.: Observer design and detection for nonlinear descriptor systems. *International Journal of Control* 67, 153–168 (1997)
176. Sontag, E.D.: The ISS Philosophy as a Unifying Framework for Stability-Like Behavior. In: *Nonlinear Control in the Year 2000. LNCIS*, vol. 259, pp. 443–468. Springer, Heidelberg (2000)
177. Shao, Z.H.: Robust stability of two-time-scale systems with nonlinear uncertainties. *IEEE Transactions on Automatic Control* 49, 258–261 (2004)
178. Shao, Z.H., Sawan, M.E.: Stabilisation of uncertain singularly perturbed systems. *IEE Proc.-Control Theory Appl.* 153, 99–103 (2006)
179. Sen, S., Datta, K.B.: Stability bounds of singularly perturbed systems. *IEEE Transactions on Automatic Control* 38, 302–304 (1993)
180. Silva, M., De Lima, T.: Looking for nonnegative solutions of a Leontief dynamic model. *Linear Algebra and its Applications* 364, 281–316 (2003)
181. Su, W.C., Gajic, Z., Shen, X.M.: The exact slow-fast decomposition of the algebraic Riccati equation of singularly perturbed systems. *IEEE Transactions on Automatic Control* 37, 1456–1459 (1992)
182. Saksena, V.R., Kokotovic, P.V.: Singular perturbation of the popov-kalman-yakubovich lemma. *Systems & Control Letters* 1, 65–68 (1981)
183. Saberi, A., Khalil, H.: Quadratic-type Lyapunov functions for singularly perturbed systems. *IEEE Transactions on Automatic Control* 29, 542–550 (1984)
184. Sathanathan, S., Keel, L.H.: Optimal practical stabilization and controllability of systems with Markovian jumps. *SIAM Journal on Algebraic and Discrete Mathematics* 54, 1011–1027 (2003)

185. Sun, W., Khargonekar, P., Shim, D.: Solution to the positive real control problem for linear time-invariant systems. *IEEE Transactions on Automatic Control* 39, 2034–2046 (1994)
186. Son, J.W., Lim, J.T.: Robust stability of nonlinear singularly perturbed system with uncertainties. *Proceedings-Control Theory and Applications* 153, 104–110 (2006)
187. Sontag, E.D., Wang, Y.: On characterizations of the input-to-state stability property. *Systems & Control Letters* 24, 351–359 (1995)
188. Takaba, K.: Robust H_2 control of descriptor system with uncertainty. *International Journal of Control* 71, 559–579 (1998)
189. Takaba, K.: Linear quadratic optimal control for linear implicit system. In: *Proceedings of the IEEE Conference on Decision and Control*, pp. 4074–4079 (1999)
190. Tuan, H.D., Hosoe, S.: On linear robust H_∞ controllers for a class of nonlinear singular perturbed systems. *Automatica* 35, 735–739 (1999)
191. Tuan, H.D., Hosoe, S.: Multivariable circle criteria for multiparameter singularly perturbed systems. *IEEE Transactions on Automatic Control* 45, 720–725 (2000)
192. Tan, W., Leung, T., Tu, Q.: H_∞ control for singularly perturbed systems. *Automatica* 34, 255–260 (1998)
193. Tong, V.V., Mahmoud, E.S.: H_∞ control for singularly perturbed systems via game theory. In: *Conference Record of the Twenty-Sixth Asilomar Conference on Signals, Systems and Computers*, pp. 415–419 (1992)
194. Trinh, H., Nahavandi, S., Tran, T.D.: Algorithms for designing reduced-order functional observers of linear systems. *International Journal of Innovative Computing, Information and Control* 4, 321–334 (2008)
195. Takagi, T., Sugeno, M.: Fuzzy identification of systems and its applications to modeling and control. *IEEE Transactions on Systems, Man and Cybernetics* 15, 116–132 (1985)
196. Taniguchi, T., Tanaka, K., Wang, H.O.: Fuzzy descriptor systems and nonlinear model following control. *IEEE Transactions on Fuzzy Systems* 8, 442–452 (2000)
197. Taniguchi, T., Tanaka, K., Yanafuji, K., Wang, H.O.: Fuzzy descriptor systems: stability analysis and design via LMIs. In: *Proceedings of the American Control Conference*, pp. 1827–1831 (1999)
198. Ugrinovskii, V.A., Petersen, I.R.: Guaranteed cost control of uncertain systems via Lur'e-Postnikov Lyapunov functions. *Automatica* 36, 279–285 (2000)
199. Vidyasagar, M.: *Nonlinear Systems Analysis*. Prentice Hall, Englewood Cliffs (1978)
200. Vladimir, B.: Partial stability of motion of semi-state systems. *International Journal of Control* 44(5), 1383–1394 (1986)
201. Vladimir, B.: Lyapunov function candidates for semi-state systems. *International Journal of Control* 46(6), 2171–2181 (1987)
202. Vidyasagar, M.: *Nonlinear Systems Analysis*. Prentice Hall, Englewood Cliffs (1993)
203. Vladimir, B., Mirko, M.: Extended stability of motion of semi-state systems. *International Journal of Control* 46(6), 2183–2197 (1987)
204. Venkatasubramanian, V., Schattler, H., Zaborszky, J.: Local bifurcations and feasibility regions in differential-algebraic systems. *IEEE Transactions on Automatic Control* 40(12), 1992–2013 (1995)
205. Venkatasubramanian, V., Saberi, A., Lin, Z.: On the validity of solutions and equilibrium points in a nonlinear network. *IEEE Transactions on Circuits System. I: Fundamental Theory and Applications* 43(4), 233–235 (1996)
206. Wohnam, W.M.: *Linear Multivariable Control: a Geometric Approach*. Springer, New York (1985)
207. Wang, F.Y., Balas, M.J.: Doubly coprime fractional representations of generalized dynamical systems. *IEEE Transactions on Automatic Control* 34(7), 733–734 (1989)

208. Wang, H., Lin, Y., Xue, A., Pan, H., Lu, R.: Reliable robust H_∞ tracking control for a class of uncertain Lur'e singular systems. *Acta Automatica Sinica* 34, 893–899 (2008)
209. Wang, H.S., Chang, F.R.: The generalized state-space description of positive realness and bounded realness. In: *Proceedings of the 39th Midwest Symposium on Circuits and Systems*, pp. 893–896 (1996)
210. Wang, Q.H., Zhou, S.X.: Singularity Induced Bifurcation in Power System Differential Algebraic Model. *Proceedings of the CSEE* 23, 18–22 (2003)
211. Wang, Q.H., Zhou, S.X.: Hopf Bifurcation Analysis of Power System Singularly Perturbed Ordinary Differential Model. *Proceedings of the CSEE* 23, 1–6 (2003)
212. Wang, Y.: *Stability Analysis and Control of Fuzzy Descriptor Systems*. Ph.D Thesis, Northeastern University, Shenyang (2003) (in Chinese)
213. Wang, Y.Y., Frank, P.M., Wu, N.E.: Near-optimal control of nonstandard singularly perturbed systems. *Automatica* 30, 277–292 (1994)
214. Wu, M., He, Y., Liu, G., She, J.: On absolute stability of Lur'e control systems with multiple non-linearities. *European Journal of Control* 11, 19–28 (2005)
215. Wu, H., Mizukami, K.: Lyapunov stability theory and robust control of uncertain descriptor systems. *International Journal of Systems Science* 26, 1981–1991 (1995)
216. Wang, Y.Y., Shi, S.J., Zhang, Z.J.: A descriptor system approach singular perturbation of linear regulators. *IEEE Transactions on Automatic Control* 33, 370–373 (1988)
217. Wang, J., Wang, J., Li, H.: Nonlinear PI control of a class of nonlinear singularly perturbed systems. *Proceedings-Control Theory and Applications* 152, 560–566 (2005)
218. Wang, H.S., Yung, C.F., Chang, F.R.: Bounded real lemma and H_∞ control for descriptor systems. *IEEE Proceedings-Control Theory and Applications* 145, 316–322 (1998)
219. Wu, H., Yung, C., Chang, F.: H_∞ control for nonlinear descriptor systems. *IEEE Transactions on Automatic Control* 47, 1919–1925 (2002)
220. Xie, H.M.: *Absolute Motion Stability and Its Application*. Science Press, Beijing (1986) (in Chinese)
221. Xie, L.: Output feedback H_∞ control of systems with parameter uncertainty. *International Journal of Control* 63, 741–750 (1996)
222. Xu, S., Lam, J.: New positive realness conditions for uncertain discrete descriptor systems: analysis and synthesis. *IEEE Transactions on Circuits and Systems I: Fundamental Theory and Applications* 51, 1897–1905 (2004)
223. Xu, S., Lam, J.: Reduced-order H_∞ filtering for singular systems. *Systems & Control Letters* 56, 48–57 (2007)
224. Xu, S., Lam, J., Zou, Y.: H_∞ filtering for singular systems. *IEEE Transactions on Automatic Control* 48, 2217–2222 (2003)
225. Xu, H., Mizukami, K.: Nonstandard extension of H_∞ optimal control for singularly perturbed systems. In: *Proceedings of the 7th International Symposium on Dynamic Games and Applications*, pp. 931–948 (1996)
226. Xu, H., Mukaidani, H., Mizukami, K.: New method for composite optimal control of singularly perturbed systems. *International Journal of Systems Science* 28, 161–172 (1997)
227. Xu, S.Y., Yang, C.W.: On Stability Analysis of Generalized Interval Dynamic Systems. *Control Theory and Applications* 17, 249–254 (2000) (in Chinese)
228. Xu, S.Y., Yang, C.W.: Stabilization of discrete-time singular systems: a matrix inequalities approach. *Automatica* 35, 1613–1617 (1999)
229. Xu, S.Y., Yang, C.W.: An algebraic approach to robust stability analysis and robust stabilization of uncertain singular systems. *International Journal of Systems Science* 31, 55–61 (2000)

230. Yang, C.W., Tan, H.L.: The Minimal Realization Problem of Singular Systems. *Control Theory and Applications* 5, 72–77 (1988) (in Chinese)
231. Yang, D.M., Zhang, Q.L., Yao, B.: *Singular Systems*. Science Press, Beijing (2003) (in Chinese)
232. Yuan, Y.H.: *Analysis and Synthesis for a Kind of T-S Fuzzy Descriptor Systems*. Ph.D Thesis, Northeastern University, Shenyang (2007) (in Chinese)
233. Yang, G.H., Dong, J.X.: Control synthesis of singularly perturbed fuzzy systems. *IEEE Transactions on Fuzzy Systems* 16, 615–629 (2008)
234. Yue, D., Han, Q.: Robust H_∞ filter design of uncertain descriptor systems with discrete and distributed delays. *IEEE Transactions on Signal Processing* 52, 3200–3212 (2004)
235. Yoneyama, J., Ichikawa, A.: H_∞ control for Takagi-Sugeno fuzzy descriptor systems. In: *Proceedings of the IEEE International Conference on Systems, Man and Cybernetics*, pp. 28–33 (1999)
236. Yeu, T., Kim, H., Kawaji, S.: Fault detection, isolation and reconstruction for descriptor systems. *Asian Journal of Control* 7, 356–367 (2005)
237. Yasuda, K., Noso, F.: Decentralized quadratic stabilization of interconnected descriptor systems. In: *Proceedings of the IEEE Conference on Decision and Control*, pp. 4264–4269 (1996)
238. Yang, L.J., Tang, Y.: An improved version of the singularity-induced bifurcation theorem. *IEEE Transactions on Automatic Control* 46, 1483–1486 (2001)
239. Yang, C., Zhang, Q., Zhou, L.: Lur’e Lyapunov functions and absolute stability criteria for Lur’e systems with multiple nonlinearities. *International Journal of Robust and Nonlinear Control* 17, 829–841 (2007)
240. Zak, S.H., Maccarley, C.A.: State-feedback control of non-linear systems. *International Journal of Control* 43, 1497–1514 (1986)
241. Zhao, S.X.: On absolute stability of control systems with several executive elements. *Science in China, Ser. A* 12, 785–792 (1987) (in Chinese)
242. Zhang, L.Q., Huang, B., Lam, J.: LMI synthesis of H_2 and mixed H_2/H_∞ controllers singular systems. *IEEE Transactions on Circuits and Systems II: Analog and Digital Signal Processing* 50, 615–626 (2003)
243. Zhang, L., Lam, J., Xu, S.: On positive realness of descriptor systems. *IEEE Transactions on Circuits and Systems I: Fundamental Theory and Applications* 49, 401–407 (2002)
244. Zhang, H.S., Chai, T.Y., Liu, X.J.: A unified approach to optimal estimation for discrete-time stochastic singular systems. *Automatica* 34, 777–781 (1998)
245. Zhang, H.S., Xie, L.H., Soh, Y.C.: Risk sensitive filtering, prediction and smoothing for discrete-time singular systems. *Automatica* 39, 57–66 (2003)
246. Zhang, J.S.: *Descriptor Systems in Economical Cybernetics*. Tsinghua University Press (1990) (in Chinese)
247. Zhang, Q.L.: *Decentralized and Robust Control for Large Scale Descriptor Systems*. Northwestern Polytechnic University Press, Xian (1997) (in Chinese)
248. Zhang, Q.L.: Analysis and Synthesis of Robust Stability for Linear Time-Invariant Descriptor Systems. *Control Theory and Applications* 16, 525–528 (1999) (in Chinese)
249. Zhang, Q.L., Yang, D.M.: *The Analysis and Synthesis of Singular Systems with Uncertainty*. Northeast University Press, Shenyang (2003) (in Chinese)
250. Zhu, B.: *Analysis and Synthesis for a Kind of T-S Fuzzy Descriptor Systems*. Ph. D. Thesis, Northeastern University, Shenyang (2006) (in Chinese)
251. Zimmera, G., Meierb, J.: On observing nonlinear descriptor systems. *Systems & Control Letters* 32, 43–48 (1997)
252. Zhao, X.L.: *Dynamic Input-Output Models of Investment*. Liaoning People’s Publishing House, Shenyang (1991) (in Chinese)

Index

- singular systems, 1
- descriptor systems, 1
- implicit systems, 2,
- generalized state-space systems, 1
- semi-state systems, 1
- differential-algebraic systems, 1
- circuit network, 2
- pendulum, 3
- prey-predator model, 4
- bifurcation, 5
- power system, 5
- linear singular systems, 5
- nonlinear singular systems, 7
- T-S fuzzy singular systems, 7
- singularly perturbed systems, 8
- optimal control, 9
- H_∞ control, 9
- practical stability, 14
- Lyapunov stability, 14
- Lyapunov second method, 14
- differential inequalities, 14
- comparison system, 15
- comparison principle, 15, 42
- Lyapunov function, 16
- consistent initial conditions, 16
- uniformly practically stable, 16
- Dini derivative, 18
- admissible control, 25
- admissible control set, 25
- regular, 28
- asymptotically stable, 28
- impulse controllable, 29, 51
- impulsive-free, 29
- admissible, 28
- time-delay, 34
- two measurements, 34
- practical stabilization, 40
- practical quasi stable
- uniformly practically quasi stable, 41
- strongly uniformly practically stable, 41
- asymptotically quasi stable, 41
- nonlinearities isolation method, 49
- Lur'e system, 49
- impulse observable, 51
- finite dynamics detectable, 51
- S-observable, 51
- finite dynamic controllable, 50
- S-controllable, 50
- restricted equivalent form, 51
- implicit function theorem, 51
- Lur'e singular system, 52, 101
- Index one, 51
- strongly absolute stability, 52
- sector constraint, 52
- S-procedure, 52
- positive realness, 54
- strict positive realness, 54
- extended strict positive realness, 54
- proper, 57
- finite mode, 57
- impulsive mode, 57
- finite pole, 57
- infinite pole, 57
- Nyquist stability condition, 61
- circle criterion, 60
- Nyquist plot, 61
- loop transformation, 63
- generalized Lyapunov function, 68

- Popov criterion, 73
- Lur'e Lyapunov function, 85
 - generalized Lure Lyapunov function, 85
 - input-to-state stability, 101
 - finite-time boundedness, 101
 - ISS gain, 101
 - transient bound, 101
 - input-to-output stability, 108
- Lipschitz nonlinearity
 - full-order observer, 129
 - reduced-order observer, 132
- H_∞ observer, 138
- slope-restricted nonlinearities, 144
- stability bound, 156
- Lur'e singularly perturbed systems
 - ε -dependent Lur'e Lyapunov function, 164
- LMI region, 179
- D-stable, 179
- pole placement constraint, 176
- H_∞ control, 179
- T-S fuzzy singularly perturbed systems, 175
- inverted pendulum