Contents

1 First Order Quasilinear Hyperbolic Systems ................. 1
  1.1 1-D First Order Quasilinear Hyperbolic Systems ............ 1
  1.2 Characteristic Form of Hyperbolic System .................. 3
  1.3 Reducible Quasilinear Hyperbolic System. Riemann Invariants . 4
  1.4 Saint-Venant System for Unsteady Flows on a Single
      Open Canal ......................................... 5
  1.5 Semi-global $C^1$ Solutions to the Mixed Initial-Boundary
      Value Problem ...................................... 7
  1.6 Exchanging the Role of $t$ and $x$ .......................... 10
  1.7 Uniqueness of $C^1$ Solution to the One-Sided Mixed
      Initial-Boundary Value Problem ....................... 11

2 Quasilinear Wave Equations ............................... 15
  2.1 1-D Quasilinear Wave Equations ........................... 15
  2.2 Semi-global $C^2$ Solutions to the Mixed Initial-Boundary
      Value Problem ...................................... 16
  2.3 Uniqueness of $C^2$ Solution to the One-Sided Mixed
      Initial-Boundary Value Problem ....................... 19

3 Semi-global Piecewise Classical Solutions on a Tree-Like
   Network .............................................. 23
  3.1 Introduction ....................................... 23
  3.2 Semi-global Piecewise $C^1$ Solutions to 1-D First Order
      Quasilinear Hyperbolic Systems on a Tree-Like Network .... 23
  3.3 Semi-global Piecewise $C^2$ Solutions to 1-D Quasilinear
      Wave Equations on a Tree-Like Network .................. 27

4 Exact Boundary Controllability of Nodal Profile
   for 1-D First Order Quasilinear Hyperbolic Systems .......... 31
  4.1 Introduction ....................................... 31
  4.2 Definitions and Main Results ........................... 32
  4.3 Proof of Theorem 4.1 ............................... 35
4.4 Proof of Theorem 4.2 ........................................ 37
4.5 Exact Boundary Controllability of Nodal Profile
for Saint-Venant System on a Single Open Canal .......... 40
4.6 Remarks .................................................. 46

5 Exact Boundary Controllability of Nodal Profile for 1-D
First Order Quasilinear Hyperbolic Systems on a Tree-Like
Network ......................................................... 47
5.1 Exact Boundary Controllability of Nodal Profile
for Saint-Venant System on a Star-Like Network
of Open Canals (Case 1) .................................. 48
5.2 Exact Boundary Controllability of Nodal Profile
for Saint-Venant System on a Star-Like Network
of Open Canals (Case 2) .................................. 53
5.3 Exact Boundary Controllability of Nodal Profile
for Saint-Venant System on a Star-Like Network
of Open Canals (Case 3) .................................. 55
5.4 Exact Boundary Controllability of Nodal Profile
for Saint-Venant System on a Star-Like Network
of Open Canals (Case 4) .................................. 58
5.5 Exact Boundary Controllability of Nodal Profile
for Saint-Venant System on a Star-Like Network
of Open Canals (Case 5) .................................. 62
5.6 Exact Boundary Controllability of Nodal Profile
for Saint-Venant System on a Tree-Like Network
of Open Canals ............................................ 64
5.7 Exact Boundary Controllability of Nodal Profile
for Saint-Venant System on a Tree-Like Network
of Open Canals (Continued) ................................ 71
5.8 Remarks .................................................. 73

6 Exact Boundary Controllability of Nodal Profile for 1-D
Quasilinear Wave Equations .................................. 75
6.1 Introduction .............................................. 75
6.2 Definitions and Main Results ............................ 75
6.3 Proof of Theorem 6.1 .................................... 78
6.4 Proof of Theorem 6.2 .................................... 80
6.5 Remarks .................................................. 82

7 Exact Boundary Controllability of Nodal Profile for 1-D
Quasilinear Wave Equations on a Planar Tree-Like
Network of Strings ............................................ 83
7.1 Introduction .............................................. 83
7.2 Exact Boundary Controllability of Nodal Profile for 1-D
Quasilinear Wave Equations on a Star-Like Network
of Strings ...................................................... 83
7.3 Exact Boundary Controllability of Nodal Profile for 1-D Quasilinear Wave Equations on a Star-Like Network of Strings (Continued) .................................. 91
7.4 Exact Boundary Controllability of Nodal Profile for Quasilinear Wave Equations on a Planar Tree-Like Network of Strings ..................................... 97
7.5 Exact Boundary Controllability of Nodal Profile for Quasilinear Wave Equations on a Planar Tree-Like Network (Continued) ................................... 101
7.6 Remarks ............................................................................. 102

References .................................................................................. 103

Index ............................................................................................. 105
Exact Boundary Controllability of Nodal Profile for Quasilinear Hyperbolic Systems
Li, T.; Wang, K.; Gu, Q.
2016, IX, 108 p. 27 illus., Softcover
ISBN: 978-981-10-2841-0