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(continued after index)

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Springer

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Frederick F. Ling
Editor-in-Chief

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Series Preface

Mechanical engineering, and engineering discipline born of the needs of the industrial revolution, is once again asked to do its substantial share in the call for industrial renewal. The general call is urgent as we face profound issues of productivity and competitiveness that require engineering solutions, among others. The Mechanical Engineering Series is a series featuring graduate texts and research monographs intended to address the need for information in contemporary areas of mechanical engineering.

The series is conceived as a comprehensive one that covers a broad range of concentrations important to mechanical engineering graduate education and research. We are fortunate to have a distinguished roster of consulting editors, each an expert in one of the areas of concentration. The names of the consulting editors are listed on page vi of this volume. The areas of concentration are applied mechanics, biomechanics, computational mechanics, dynamic systems and control, energetics, mechanics of materials, processing, thermal science, and tribology.

Preface

As a research advisor to graduate students working on automotive projects, I have frequently felt the need for a textbook that summarizes common vehicle control systems and the dynamic models used in the development of these control systems. While a few different textbooks on ground vehicle dynamics are already available in the market, they do not satisfy all the needs of a control systems engineer. A controls engineer needs models that are both simple enough to use for control system design but at the same time rich enough to capture all the essential features of the dynamics. This book attempts to present such models and actual automotive control systems from literature developed using these models.

The control system topics covered in the book include cruise control, adaptive cruise control, anti-lock brake systems, automated lane keeping, automated highway systems, yaw stability control, engine control, passive, active and semi-active suspensions, tire models and tire-road friction estimation. A special effort has been made to explain the several different tire models commonly used in literature and to interpret them physically.

As the worldwide use of automobiles increases rapidly, it has become ever more important to develop vehicles that optimize the use of highway and fuel resources, provide safe and comfortable transportation and at the same time have minimal impact on the environment. To meet these diverse and often conflicting requirements, automobiles are increasingly relying on electromechanical systems that employ sensors, actuators and feedback control. It is hoped that this textbook will serve as a useful resource to researchers who work on the development of such control systems, both in

the automotive industry and at universities. The book can also serve as a textbook for a graduate level course on Vehicle Dynamics and Control.

An up-to-date errata for typographic and other errors found in the book after it has been published will be maintained at the following web-site:

http://www.menet.umn.edu/~rajamani/vdc.html

I will be grateful for reports of such errors from readers.

Rajesh Rajamani
Minneapolis, Minnesota
May 2005

Contents

Dedication v

Preface ix

Acknowledgments xxv

1. INTRODUCTION 1

1.1 Driver Assistance Systems 2

1.2 Active Stability Control Systems 2

1.3 Ride Quality 4

1.4 Technologies for Addressing Traffic Congestion 5

1.4.1 Automated highway systems 6

1.4.2 Traffic friendly adaptive cruise control 6

1.4.3 Narrow tilt-controlled comuuter vehicles 7

1.5 Emissions and Fuel Economy 9

1.5.1 Hybrid electric vehicles 10

1.5.2 Fuel cell vehicles 11

References 11

2. LATERAL VEHICLE DYNAMICS 15

2.1 Lateral Systems Under Commercial Development 15

2.1.1 Lane departure warning 16

2.1.2 Lane keeping systems 17

2.1.3 Yaw stability control systems 18

2.2 Kinematic Model of Lateral Vehicle Motion 20

2.3 Bicycle Model of Lateral Vehicle Dynamics 27

2.4 Motion of Particle Relative to a rotating Frame 33

2.5 Dynamic Model in Terms of Error with Respect to Road 35

2.6 Dynamic Model in Terms of Yaw Rate and Slip Angle 39

2.7 From Body-Fixed to Global Coordinates 41

2.8 Road Model 43

2.9 Chapter Summary 46

Nomenclature 47

References 48

3. STEERING CONTROL FOR AUTOMATED LANE KEEPING 51

3.1 State Feedback 51

3.2 Steady State Error from Dynamic Equations 55

3.3 Understanding Steady State Cornering 59

3.3.1 Steering angle for steady state cornering 59

3.3.2 Can the yaw angle error be zero? 64

3.3.3 Is non-zero yaw error a concern? 65

3.4 Consideration of Varying Longitudinal Velocity 66

3.5 Output Feedback 68

3.6 Unity feedback Loop System 70

3.7 Loop Analysis with a Proportional Controller 72

3.8 Loop Analysis with a Lead Compensator 79

3.9 Simulation of Performance with Lead Compensator 83

3.10 Analysis if Closed-Loop Performance 84

3.10.1 Performance variation with vehicle speed 84

3.10.2 Performance variation with sensor location 86

3.11 Compensator Design with Look-Ahead Sensor Measurement 88

3.12 Chapter Summary 90

Nomenclature 90

References 92

4. LONGITUDINAL VEHICLE DYNAMICS 95

4.1 Longitudinal Vehicle Dynamics 95

4.1.1 Aerodynamic drag force 97

4.1.2 Longitudinal tire force 99

4.1.3 Why does longitudinal tire force depend on slip? 101

4.1.4 Rolling resistance 104

4.1.5 Calculation of normal tire forces 106

4.1.6 Calculation of effective tire radius 108

4.2 Driveline Dynamics 111

4.2.1 Torque converter 112

4.2.2 Transmission dynamics 114

4.2.3 Engine dynamics 116

4.2.4 Wheel dynamics 118

4.3 Chapter Summary 120

Nomenclature 120

References 122

5. INTRODUCTION TO LONGITUDINAL CONTROL 123

5.1 Introduction 123

5.1.1 Adaptive cruise control 124

5.1.2 Collision avoidance 125

5.1.3 Automated highway systems 125

5.2 Benefits of Longitudinal Automation 126

5.3 Cruise Control 128

5.4 Upper Level Controller for Cruise Control 130

5.5 Lower Level for Cruise Control 133

5.5.1 Engine torque calculation for desired acceleration 134

5.5.2 Engine control 137

5.6 Anti-Lock Brake Systems 137

5.6.1 Motivation 137

5.6.2 ABS functions 141

5.6.3 Deceleration threshold based algorithms 142

5.6.4 Other logic based ABS control systems 146

5.6.5 Recent research publications on ABS 148

5.7 Chapter Summary 148

Nomenclature 149

References 150

6. ADAPTIVE CRUISE CONTROL 153

6.1 Introduction 153

6.2 Vehicle Following Specifications 155

6.3 Control Architecture 156

6.4 String Stability 158

6.5 Autonomous Control with Constant Spacing 159

6.6 Autonomous Control with the Constant Time-Gap Policy 162

6.6.1 String stability of the CTG spacing policy 164

6.6.2 Typical delay values 167

6.7 Transitional Trajectories 169

6.7.1 The need for a transitional controller 169

6.7.2 Transitional controller design through $R - \dot{R}$ diagrams 172

6.8 Lower Level Controller 178

6.9 Chapter Summary 180

Nomenclature 180

References 181

Appendix 6.A 183

7. LONGITUDINAL CONTROL FOR VEHICLE PLATOONS 187

7.1 Automated Highway Systems 187

7.2 Vehicle Control on Automated Highway Systems 188

7.3 Longitudinal Control Architecture 189

7.4 Vehicle Following Specifications 191

7.5 Background on Norms of Signals and Systems 193

7.5.1 Norms of signals 193

7.5.2 System norms 194

7.5.3 Use of system norms to study signal amplification 195

7.6 Design Approach for Ensuring String Stability 198

7.7 Constant Spacing with Autonomous Control 200

7.8 Constant Spacing with Wireless Communication 203

7.9 Experimental Results 206

7.10 Lower Level Controller 208

7.11 Adaptive Controller for Unknown Vehicle Parameters 209

7.11.1 Redefined notation 209

7.11.2 Adaptive controller 211

7.12 Chapter Summary 214

Nomenclature 215

References 216

Appendix 7.A 218

8. ELECTRONIC STABILITY CONTROL 221

8.1 Introduction 221

8.1.1 The functioning of a stability control system 221

8.1.2 Systems developed by automotive manufacturers 223

8.1.3 Types of stability control systems 223

8.2 Differential Braking Systems 224

8.2.1 Vehicle model 224

8.2.2 Control architecture 229

8.2.3 Desired yaw rate 230

8.2.4 Desired side-slip angle 231

8.2.5 Upper bounded values of target yaw rate and slip angle 233

8.2.6 Upper controller design 235

8.2.7 Lower Controller design 238

8.3 Steer-By-Wire Systems 240

8.3.1 Introduction 240

8.3.2 Choice of output for decoupling 241

8.3.3 Controller design 244

8.4 Independent All Wheel Drive Torque Distribution 247

8.4.1 Traditional four wheel drive systems 247

8.4.2 Torque transfer between left and right wheels 248

8.4.3 Active control of torque transfer to all wheels 249

8.5 Chapter Summary 251

Nomeclature 252

References 255

9. MEAN VALUE MODELING OF SI AND DIESEL ENGINES 257

9.1 SI Engine Model Using Parametric Equations 258

9.1.1 Engine rotational dynamics 259

9.1.2 Indicated combustion torque 260

9.1.3 Friction and pumping losses 261

9.1.4 Manifold pressure equation 262

9.1.5 Outflow rate from intake manifold 263

9.1.6 Inflow rate into intake manifold 263

9.2 SI Engine Model Using Look-Up Maps 265

9.2.1 Introduction to engine maps 266

9.2.2 Second order engine model using engine maps 270

9.2.3 First order engine model using engine maps 271

9.3 Introduction to Turbocharged Diesel Engine Maps 273

9.4 Mean Value Modeling of Turbocharged Diesel Engines 274

9.4.1 Intake manifold dynamics 275

9.4.2 Exhaust manifold dynamics 275

9.4.3 Turbocharger dynamics 276

9.4.4 Engine crankshaft dynamics 277

9.4.5 Control system objectives 278

9.5 Lower Level Controller with SI Engines 279

9.6 Chapter Summary 281

Nomenclature 282

References 284

10. DESIGN AND ANALYSIS OF PASSIVE AUTOMOTIVE SUSPENSIONS 287

10.1 Introduction to Automotive Suspensions 287

10.1.1 Full, half and quarter car suspension models 287

10.1.2 Suspension functions 289

10.1.3 Dependent and independent suspensions 291

10.2 Modal Decoupling 293

10.3 Performance Variables for a Quarter Car Suspension 295

10.4 Natural Frequencies and Mode Shapes for the Quarter Car 297

10.5 Approximate Transfer Functions Using Decoupling 299

10.6 Analysis of Vibrations in the Sprung Mass Mode 305

10.7 Analysis of Vibrations in the Unsprung Mass Mode 307

10.8 Verification Using the Complete Quarter Model 308

10.8.1 Verification of the influence of suspension stiffness 308

10.8.2 Verification of the influence of suspension damping 310

10.8.3 Verification of the influence of tire stiffness 313

10.9 Half-Car and Full-Car Suspension Models 315

10.10 Chapter Summary 321

Nomenclature 322

References 323

11. ACTIVE AUTOMOTIVE SUSPENSIONS 325

11.1 Introduction 325

11.2 Active Control: Trade-Offs and Limitations 328

11.2.1 Transfer functions of interest 328

11.2.2 Use of the LQR Formulation and its relation to H_2 Optimal Control 328

11.2.3 LQR formulation for active suspension design 330

11.2.4 Performance studies of the LQR controller 332

11.3 Active System Asymptotes 339

11.4 Invariant Points and Their Influence on the Suspension Problem 341

11.5 Analysis of Trade-Offs Using Invariant Points 343

11.5.1 Ride quality/ road holding trade-offs 344

11.5.2 Ride quality/ rattle space trade-offs 345

11.6 Conclusions on Achievable Active System Performance 346

11.7 Performanceof a Simple Velocity Feedback Controller 348

11.8 Hydraulic Actuators for Active Suspensions 350

11.9 Chapter Summary 352

Nomenclature 353

References 354

12. SEMI-ACTIVE SUSPENSIONS 357

12.1 Introduction 357

12.2 Semi-Active Suspension Model 359

12.3 Theoretical Results: Optimal Semi-Active Suspensions 362

12.3.1 Problem formulation 362

12.3.2 Problem definition 364

12.3.3 Optimal solution with no constraints on damping 365

12.3.4 Optimal solution in the presence of constraints 368

12.4 Interpretation of the Optimal Semi-Active Control Law 369

12.5 Simulation Results 372

12.6 Calculation of Transfer Function Plots with Semi-Active Suspensions 375

12.7 Performance of Semi-Active Suspension Systems 378

12.7.1 Moderately weighted ride quality 378

12.7.2 Sky hook damping 380

12.8 Chapter Summary 383

Nomenclature 383

References 384

13. LATERAL AND LONGITUDINAL TIRE FORCES 387

13.1 Tire Forces 387

13.2 Tire Structure 390

13.3 Longitudinal Tire Force at Small Slip Ratios 391

13.4 Lateral Tire Force at Small Slip Angles 395

13.5 Introduction to the Magic Formula Tire Model 398

13.6 Development of Lateral Tire Model for Uniform Normal Force Distribution 400

13.6.1 Lateral forces at small slip angles 402

13.6.2 Lateral forces at large slip angles 405

13.7 Development of Lateral Tire Model for Parabolic Normal Pressure Distribution 409

13.8 Combined Lateral and Longitudinal Tire Force Generation 417

13.9 The Magic Formula Tire Model 421

13.10 Dugoff's Tire Model 425

13.10.1 Introduction 425

13.10.2 Model equations 426

13.10.3 Friction Circle Interpretation of Dugoff's Model 427

13.11 Dynamic Tire Model 429

13.12 Chapter Summary 430

Nomenclature 430

References 432

14. TIRE-ROAD FRICTION MEASUREMENT ON HIGHWAY VEHICLES 433

14.1 Introduction 433

14.1.1 Definition of tire-road friction coefficient 433

14.1.2 Benefits of tire-road friction estimation 434

14.1.3 Review of results on tire-road friction coefficient estimation 435

14.1.4 Review of results on slip-slope based approach to friction estimation 436

14.2 Longitudinal Vehicle Dynamics and Tire Model for Friction Estimation 438

14.2.1 Vehicle longitudinal dynamics 438

14.2.2 Determination of the normal force 439

14.2.3 Tire model 440

14.2.4 Friction coefficient estimation for both traction and braking 442

14.3 Summary of Longitudinal Friction identification Approach 446

14.4 Identification Algorithm Design 447

14.4.1 Recursive least-squares (RLS) identification 447

14.4.2 RLS with gain switching 449

14.4.3 Conditions for parameter updates 450

14.5 Estimation of Accelerometer Bias 451

14.6 Experimental Results 454

14.6.1 System hardware and software 454

14.6.2 Tests on dry concrete surface 455

14.6.3 Tests on concrete surface with loose snow covering 457

14.6.4 Tests on surface consisting of two different friction levels 459

14.6.5 Hard braking test 460

14.7 Chapter Summary 461

Nomenclature 462

References 464

Index 467

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Minneapolis, Minnesota
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