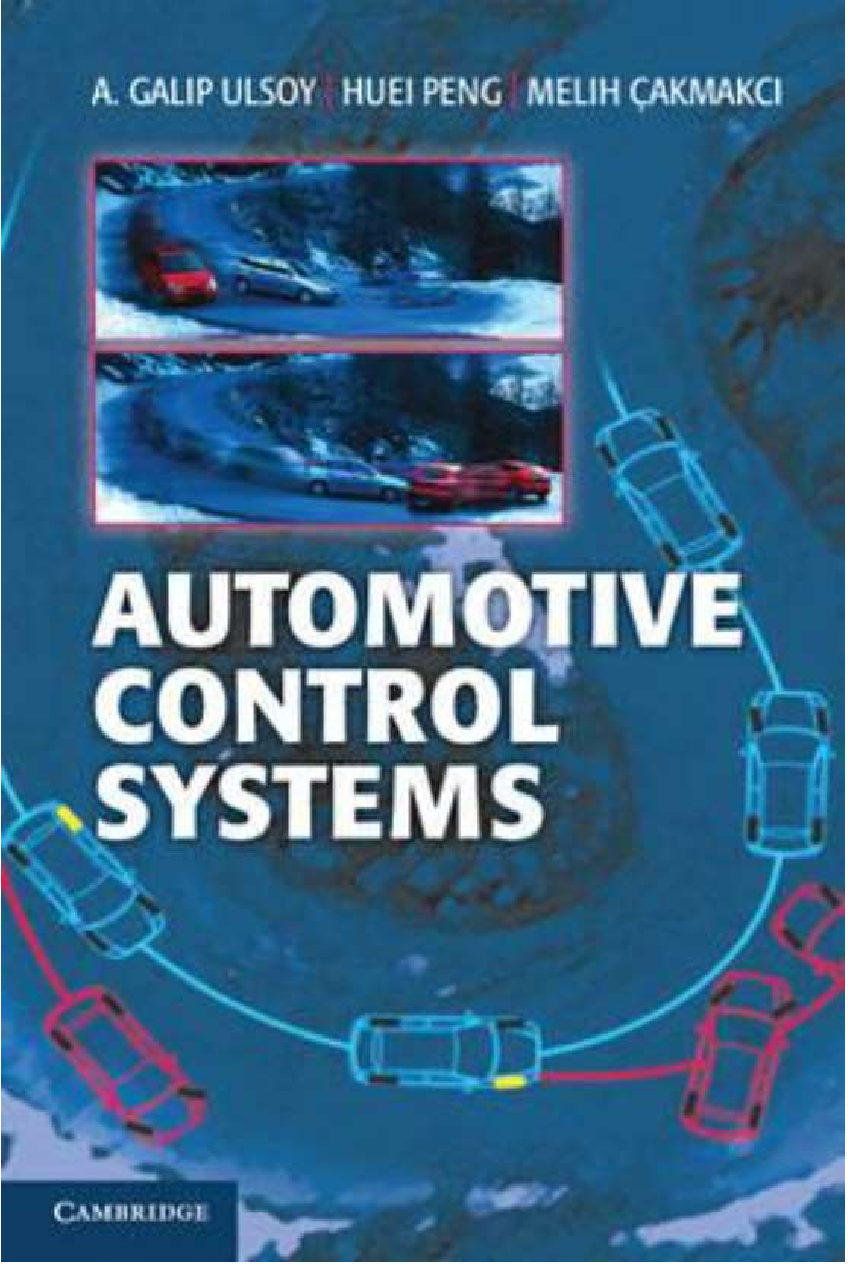
A. GALIP ULSOY | HUEI PENG | MELIH ÇAKMAKCI
AUTOMOTIVE CONTROL SYSTEMS
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AUTOMOTIVE CONTROL SYSTEMS

This engineering textbook is designed to introduce advanced control systems for vehicles, including advanced automotive concepts and the next generation of vehicles for Intelligent Transportation Systems (ITS). For each automotive-control problem considered, the authors emphasize the physics and underlying principles behind the control-system concept and design. This is an exciting and rapidly developing field for which many articles and reports exist but no modern unifying text. An extensive list of references is provided at the end of each chapter for all topics covered. This is currently the only textbook, including problems and examples, that covers and integrates the topics of automotive powertrain control, vehicle control, and ITS. The emphasis is on fundamental concepts and methods for automotive control systems rather than the rapidly changing specific technologies. Many of the text examples, as well as the end-of-chapter problems, require the use of MATLAB and/or Simulink.

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Preface

This textbook is organized in four major parts as follows:

I. *Introduction and Background* is an introduction to the topic of automotive control systems and a review of background material on engine modeling, vehicle dynamics, and human factors.
II. *Powertrain Control Systems* includes topics such as air–fuel ratio control, idle-speed control, spark-timing control, control of transmissions, control of hybrid-electric vehicles, and fuel-cell vehicle control.
III. *Vehicle Control Systems* covers cruise control and headway-control systems, traction-control systems (including antilock brakes), active suspensions, vehicle-stability control, and four-wheel steering.
IV. *Intelligent Transportation Systems (ITS)* includes an overview of ITS technologies, collision detection and avoidance systems, automated highways, platooning, and automated steering.

With multiple chapters in each part, this textbook contains sufficient material for a one-semester course on automotive control systems. The coverage of the material is at the first-year graduate or advanced undergraduate level in engineering. It is assumed that students have a basic undergraduate-level background in dynamics, automatic control, and automotive engineering.

This textbook is written for engineering students who are interested in participating in the development of advanced control systems for vehicles, including advanced automotive concepts and the next generation of vehicles for ITS. This is an exciting and rapidly developing field for which numerous articles and reports exist. An extensive list of references, therefore, is provided at the end of each chapter for all topics covered. Due to the breadth of topics treated, the reference lists are by no means comprehensive, and new studies are always appearing. However, the lists cover many major contributions and the basic concepts in each sub-area. This textbook is intended to provide a framework for unifying the vast literature represented by the references listed at the end of each chapter. It is currently the only textbook, including problems and examples, that covers and integrates the topics of automotive powertrain control, vehicle control, and ITS.

The emphasis is on fundamental concepts and methods for automotive control systems rather than the rapidly changing specific technologies. For each