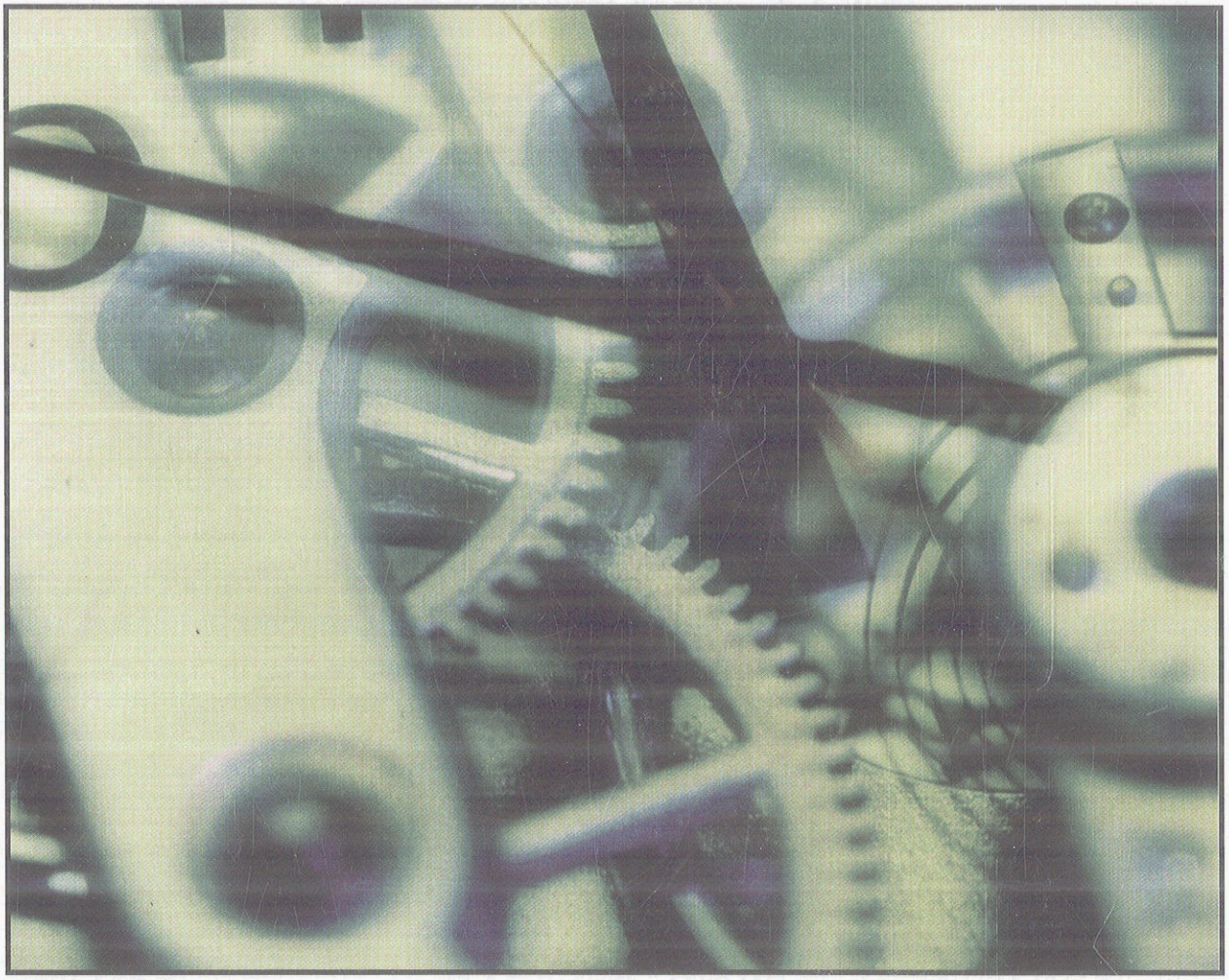
PREMIER REFERENCE SOURCE

Automotive Informatics and Communicative Systems

Principles in Vehicular Networks and Data Exchange



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Detailed Table of Contents

This chapter reviews automotive EMC requirements and discusses the design of automotive electronics for EMC. The objective of the chapter is to provide non-EMC engineers and engineering managers with basic information that will help them recognize the importance of designing for electromagnetic compatibility, rather than addressing electronic noise problems as they arise.

Chapter IV

This chapter introduces the most widely used automotive networks like LIN (Local Interconnect Network), CAN (Controller Area Network), MOST (Media-Oriented Systems Transport), and FlexRay. To fulfill the increasing demand of intra-vehicle communications, a new technique based on power line communication (PLC) is then proposed. This allows the transmission of both power and messages without functional barriers. On the other hand, there are several infotainment applications (like mobile phones, laptop computers) pushing for the adoption of intra-vehicle wireless communications. Thus, some potential wireless technologies used in the automotive domain, namely Bluetooth, IEEE 802.11 b/g wireless technology – WiFi, and Zigbee are covered here. Finally, the chapter highlights the challenges of these wired or wireless alternative solutions in automotive networks.

Chapter V

In this chapter, the author extends the use of these embedded vehicular networks by proposing to remotely monitor and control the vehicles through them, in order to realize safety and driver assistance related applications. To accomplish this task, additional technologies such as real-time wireless communications and data security are required, and each of them is introduced and described in this chapter.

Chapter VI

Numerous efforts are currently under progress to enhance the safety and efficiency of vehicular traffic through intelligent transportation systems. In addition, the growing demand for access to data and information from human users on the go has created the need for advanced vehicle-to-vehicle and vehicle-to-roadside communication systems capable of high data rates and amenable to high degrees of node mobility. Vehicular communications and networks are expected to be used for a number of purposes such as for enabling mobile users to transfer data and information from other networks such as the Internet and also for implementing services such as Intersection Decision Systems (IDS), Automated Highway Systems (AHS), and Advanced Vehicle Safety Systems (AVS). In this chapter the authors describe me-

dium access control (MAC) and routing protocols for vehicular networks and the various factors that affect their design and performance.

Chapter VII

This chapter proposes a new routing algorithm that allows communication in vehicular ad hoc networks. In vehicular ad hoc networks, the transmitter node cannot determine the immediate future position of the receiving node beforehand. Furthermore, rapid topological changes and limited bandwidth compound the difficulties nodes experience when attempting to exchange position information.

Chapter VIII

The authors describe applications that improve the operation of automobiles, control traffic lights, and distribute the load on roadways. The requirements on the communications protocols that implement the applications are determined and a new communications paradigm, neighborcast, is described. Neighborcast communicates between nearby entities, and is particularly well suited to transportation applications.

Chapter IX

The research in this chapter investigates several fundamental issues, such as the connectivity, the reachability, the interference, and the capacity, with respect to information propagation in VANETs. The authors' work is distinguished with previous efforts, since they incorporate the characteristics of traffic into these issues in the communication layer of VANETs; this mainly address the issue of the interference. Previous efforts to solve this problem only consider static network topologies. However, high node mobility and dynamic traffic features make the interference problem in VANETs quite different.

This chapter surveys traffic control strategies for optimizing traffic flow on highways, with a focus on more adaptive and flexible strategies facilitated by current advancements in sensor-enabled cars and vehicular ad hoc networks (VANETs). The authors investigate proactive merging strategies assuming that sensor-enabled cars can detect the distance to neighboring cars and communicate their velocity and acceleration among each other. Proactive merging strategies can significantly improve traffic flow by increasing it up to 100% and reduce the overall travel delay by 30%.

In this chapter, V2V and V2I applications are considered as a spatio-temporal problem. The tenet is that sharing information can be made only if this is time stamped and related to a spatial description of the information sources. The chapter formulates the spatio-temporal problem having as constraint the precision of the pose estimates of the vehicles involved. It regards the localisation problem and accuracy of digital road maps as a combined issue that needs to be addressed for the successful deployment of cooperative vehicle applications. Two case studies, intersection safely and an overtaking manoeuvre are included. Recommendations on the precision limits of the vehicle pose estimations and the potential uncertainties that need to be considered when designing V2V and V2I applications complete the chapter.

In this chapter, the authors will review the problem of estimating in real-time the position of a vehicle for use in land navigation systems. After describing the application context and giving a definition of the problem, they will look at the mathematical framework and technologies involved to design positioning systems. The authors will compare the performance of some of the most popular data fusion approaches and provide some insights on their limitations and capabilities.

Privacy, security, and reliability are key requirements in deploying vehicular ad-hoc networks (VANET). Without those the VANET technology will not be suitable for market diffusion. In this chapter, the au-

thors are concerned with how to fulfill these requirements by using pseudonym-based authentication, designing security schemes that do not endanger transport safety while maintaining low overhead. At the same time the design improves the system usability by allowing nodes to self-generate their own pseudonyms.

Chapter XIV

This chapter systematically presents actual issues regarding the simulation of VANET applications. Some of them refer to challenges in developing VANET simulators. The chapter discusses simulator architectures, models used for representing the communication among vehicles, vehicles mobility features, and simulation tool implementation methods. A critical analysis of the solutions adopted in some well-known actual simulators is also included.

Chapter XV

This book chapter describes a number of ways using which the networks of future vehicles could be designed and implemented in a cost-effective manner. The book chapter also shows how simulation models can be developed to evaluate the performance of various types of in-vehicle network topologies and select the most appropriate topology for given requirements and specifications.