Hardware In The Loop Simulation A Scalable Component Based Time Triggered Hardware In The Loop Simulation Framework

Abstract : The Electronic Control Unit (ECU) of an Electric Power Steering (EPS) system is a core device to decide how much assistance an electric motor applies on steering wheel. EPS ECUs play an important role in EPS systems. The effectiveness of EPS ECUs needs to be thoroughly tested before mass production. Hardware-in-the-loop (HIL) simulation provides an efficient way for the development and testing of embedded controllers. This report focuses on the development of HIL system for testing EPS controllers. The hardware of the HIL system employs a dSPACE HIL simulator. The EPS plant model is an integrated model consisting of Vehicle Dynamics model of the dSPACE Automotive Simulation Model (ASM) and the Nexteer model. The report presents the design of EPS HIL system, the simulation of sensors and actuators, the functions of ASM Vehicle Dynamics model, and the integration method of ASM Vehicle Dynamics model with Nexteer model. The offline simulation of the integrated model is performed and the results for different driving maneuvers are presented. The real-time HIL testing will be conducted in the future to examine the performance of an entire HIL system. Hardware in the loop simulation has been used in the last years in the automotive, navigation and aerospace industry to eliminate iterations in the design face of

hardware. This process consists in 4 main parts: The controller model or Algorithm, model of the plant, embedded hardware and the real-time processor to generate analog/digital I/O and communications. The aim of this project is to first model a subsystem (plant) that is essential in all the printers and generates a lot of problems, which is the ink delivery system. Second objective of the thesis is to integrate the 4 parts of the HIL running simulations to prove feasibility of the model and comparing it versus reality.

This book is an open access book. This book provides an overview of the ERIGrid validation methodology for validating CPES, a holistic power system testing method. It introduces readers to corresponding simulation and laboratory-based tools, including co-simulation, real-time simulation, and hardware-in-the-loop. Selected test cases and validation examples are provided, in order to support the theory discussed. The book begins with an introduction to current power system testing methods and an overview of the ERIGrid system-level validation approach. It then moves on to discuss various validation methods, concepts and tools, including simulation and laboratory-based assessment methods. The book presents test cases and validation examples of the proposed methodologies and summarises the lessons learned from the holistic validation approach. In the final section of the book, the educational aspects of these methods, the outlook for the future, and overall conclusions are discussed. Given its scope, the book will be of interest to researchers, engineers, and laboratory personnel in the fields of power systems and smart grids,

as well as undergraduate and graduate students studying related engineering topics.

This book describes the latest research advances, innovations, and visions in the field of robotics as presented by leading researchers, engineers, and practitioners from around the world at the 14th International Conference on Intelligent Autonomous Systems (IAS-14), held in Shanghai, China in July 2016. The contributions amply demonstrate that robots, machines and systems are rapidly achieving intelligence and autonomy, attaining more and more capabilities such as mobility and manipulation, sensing and perception, reasoning, and decision-making. They cover a wide range of research results and applications, and particular attention is paid to the emerging role of autonomous robots and intelligent systems in industrial production, which reflects their maturity and robustness. The contributions were selected by means of a rigorous peer-review process and highlight many exciting and visionary ideas that will further galvanize the research community and spur novel research directions. The series of biennial IAS conferences, which began in 1986, represents a premiere event in the field of robotics.

Following the successful 1st CEAS (Council of European Aerospace Societies) Specialist Conference on Guidance, Navigation and Control (CEAS EuroGNC) held in Munich, Germany in 2011, Delft University of Technology happily accepted the invitation of organizing the 2nd CEAS EuroGNC in Delft, The Netherlands in 2013. The goal of the conference is to promote new advances in aerospace GNC theory and technologies for

enhancing safety, survivability, efficiency, performance, autonomy and intelligence of aerospace systems using on-board sensing, computing and systems. A great push for new developments in GNC are the ever higher safety and sustainability requirements in aviation. Impressive progress was made in new research fields such as sensor and actuator fault detection and diagnosis, reconfigurable and fault tolerant flight control, online safe flight envelop prediction and protection, online global aerodynamic model identification, online global optimization and flight upset recovery. All of these challenges depend on new online solutions from on-board computing systems. Scientists and engineers in GNC have been developing model based, sensor based as well as knowledge based approaches aiming for highly robust, adaptive, nonlinear, intelligent and autonomous GNC systems. Although the papers presented at the conference and selected in this book could not possibly cover all of the present challenges in the GNC field, many of them have indeed been addressed and a wealth of new ideas, solutions and results were proposed and presented. For the 2nd CEAS Specialist Conference on Guidance, Navigation and Control the International Program Committee conducted a formal review process. Each paper was reviewed in compliance with good journal practice by at least two independent and anonymous reviewers. The papers published in this book were selected from the conference proceedings based on the results and recommendations from the reviewers.

Comprehensive, cross-disciplinary coverage of Smart

Grid issues from global expert researchers and practitioners. This definitive reference meets the need for a large scale, high quality work reference in Smart Grid engineering which is pivotal in the development of a low-carbon energy infrastructure. Including a total of 83 articles across 3 volumes The Smart Grid Handbook is organized in to 6 sections: Vision and Drivers, Transmission, Distribution, Smart Meters and Customers, Information and Communications Technology, and Socio-Economic Issues. Key features: Written by a team representing smart grid R&D, technology deployment, standards, industry practice, and socio-economic aspects. Vision and Drivers covers the vision, definitions, evolution, and global development of the smart grid as well as new technologies and standards. The Transmission section discusses industry practice, operational experience, standards, cyber security, and grid codes. The Distribution section introduces distribution systems and the system configurations in different countries and different load areas served by the grid. The Smart Meters and Customers section assesses how smart meters enable the customers to interact with the power grid. Socio-economic issues and information and communications technology requirements are covered in dedicated articles.The Smart Grid Handbook will meet the need for a high quality reference work to support advanced study and research in the field of electrical power generation, transmission and distribution. It will be an essential reference for regulators and government officials, testing laboratories and certification organizations, and

engineers and researchers in Smart Grid-related industries.

Conventional vehicles are creating pollution problems, global warming and the extinction of high density fuels. To address these problems, automotive companies and universities are researching on hybrid electric vehicles where two different power devices are used to propel a vehicle. This research studies the development and testing of a dynamic model for Prius 2010 Hybrid Synergy Drive (HSD), a power-split device. The device was modeled and integrated with a hybrid vehicle model. To add an electric only mode for vehicle propulsion, the hybrid synergy drive was modified by adding a clutch to carrier 1. The performance of the integrated vehicle model was tested with UDDS drive cycle using rule-based control strategy. The dSPACE Hardware-In-the-Loop (HIL) simulator was used for HIL simulation test. The HIL simulation result shows that the integration of developed HSD dynamic model with a hybrid vehicle model was successful. The HSD model was able to split power and isolate engine speed from vehicle speed in hybrid mode.

The purpose of this report is to document the Tri-FAST missile simulation development and the seeker hardware-in-the-loop (HWIL) testing in the Radio Frequency Simulation Cell of the Advanced Simulation Center (ASC). Tri- FAST is a tri-service active seeker technology program. (Author).

Safety-critical real-time systems must guarantee correct operation in all operational conditions - even if these conditions are very unlikely to occur (rare events). Hardware-

in-the-Loop (HiL) simulation is a common validation technique of real-time systems. In an HiL simulation the environment of a System-Under-Test (SUT) is simulated by an assigned HiL simulator. Thereby, the SUT interacts with the HiL simulator in real-time which necessitates a model of time and interfaces of the HiL simulator that are identical to the model of time and the interfaces of the SUT. In this book an HiL simulation framework is proposed that allows predictable interaction of a distributed HiL simulator and an SUT. This HiL simulation framework comprises configurable simulation components which are interconnected via a time-triggered interaction mechanism. Information flow between the HiL simulator and the SUT is strictly controlled by the progression of synchronized global time and bound to a priori known latency and jitter. This book addresses researchers and engineers in safety-critical domains such as the avionics or automotive industries.

Abstract : This report studies model-based embedded system design for the control of Internal Combustion (IC) engines. The advantages of model-based design and the development tools are discussed. The application of this method for IC engine control is the focus of the first part of the report. In the second part, the Hardware-In-the-Loop (HIL) simulation is introduced with emphasis on the engine controller and its modification for lean operation control. For the IC engine control, the control functionalities of an engine electronic control unit (ECU) in dSPACE Automotive Simulation Models (ASM) are analyzed. The lean combustion control model is implemented in a hardware engine ECU - MotoTron Engine Control Module (ECM) and validated by a HIL simulator. The HIL simulator used for the simulation study is dSPACE E-Drive HIL simulator. The HIL simulation result shows that the developed lean combustion control strategy can reduce fuel consumption. The lean operation at a lambda value of 1.2 is

seen to have the lowest injection duration while still producing the same amount of torque. It is also found that the implemented method is able to meet the required torque better at the lower load operating conditions. The variation in the output torque is increased at the higher load conditions.

"Hardware-in-the-loop (HIL) simulation is becoming a significant tool in prototyping complex, highly available systems. The HIL approach allows an engineer to build a physical system incrementally by enabling real components of the system to seamlessly interface with simulated components. It also permits testing of hardware prototypes of components that would be extremely costly to test in the deployed environment. Key issues are the ability to wrap the systems of equations (such as Partial Differential Equations) describing the deployed environment into real-time software models, provide low synchronization overhead between the hardware and software, and reduce reliance on proprietary platforms. This thesis introduces an open source HIL simulation framework that can be ported to any standard Unix-like system on any shared-memory multiprocessor computer, requires minimal operating system scheduler controls, provides a soft real-time guarantee for any constituent simulation that does likewise, enables an asynchronous user interface, and allows for an arbitrary number of secondary control components"--Abstract, leaf iii.

The Development of a Hardware-in-the-Loop Simulation System for Unmanned Aerial Vehicle Autopilot Design Using LabVIEW.

After the tractor-trailer model was validated, the HIL simulation was developed. Essentially, the HIL simulation integrates actual braking hardware with the computer based tractor model. For this project, the hardware consisted of a 4s4m ABS braking system with

six brake chambers, four modulators, a treadle and an electronic control unit (ECU). A dSPACE simulator was used as the "interface" between the TruckSim computer model and the hardware.

Because of their increasing requirements, modern guided missiles today have a very high degree of complexity. To improve cost-effectiveness and to reduce risk and uncertainty at the same time, new test concepts are necessary. Realtime simulations like Software-in-the-Loop and Hardware-in-the-Loop simulations represent such new concepts. This means close loop simulation with actual present missile components in a laboratory environment where the physical environment is simulated and controlled by computer equipment. After a definition of SIL/HIL-simulation, the configuration of such a test equipment is presented. It gives an overview of the complexity of the thereby necessary hardware and software.

Computational and Numerical Simulations is an edited book including 20 chapters. Book handles the recent research devoted to numerical simulations of physical and engineering systems. It presents both new theories and their applications, showing bridge between theoretical investigations and possibility to apply them by engineers of different branches of science. Numerical simulations play a key role in both theoretical and application oriented research.

Hardware in the loop simulation is presented as a powerful tool for control validation because it can be applied to vehicle designs independent of vehicle availability, and the hardware and software tested using

the process can be scalable and adaptive to relevant problems throughout the design process. Automotive manufacturers such as General Motors and Ford have been showing increased interest in HIL simulation and its benefits for improving vehicle reliability, safety, and maintenance costs. Controller validation and failure simulation have become increasingly popular uses of HIL simulation. A much faster design cycle has been a side effect, drawing the attention of other industries.

The present book includes a set of selected papers from the third “International Conference on Informatics in Control Automation and Robotics” (ICINCO 2006), held in Setúbal, Portugal, from 1 to 5 August 2006, sponsored by the Institute for Systems and Technologies of Information, Control and Communication (INSTICC). The conference was organized in three simultaneous tracks: “Intelligent Control Systems and Optimization”, “Robotics and Automation” and “Systems Modeling, Signal Processing and Control”. The book is based on the same structure. Although ICINCO 2006 received 309 paper submissions, from more than 50 different countries in all continents, only 31 where accepted as full papers. From those, only 23 were selected for inclusion in this book, based on the classifications provided by the Program Committee. The selected papers also reflect the interdisciplinary nature of the conference. The diversity of topics is an important feature of this conference, enabling an overall

perception of several important scientific and technological trends. These high quality standards will be maintained and reinforced at ICINCO 2007, to be held in Angers, France, and in future editions of this conference.

Christian Köhler covers the connection between ?C and simulation, the interface abstraction as well as the analysis and optimization of coupling systems with the Chip-Hardware-in-the-Loop Simulation (CHILS) approach. He develops the hardware to simulation coupling system with a focus on less hardware effort, the capabilities to couple with different simulation environments, and the efficiency of coupling. Furthermore, the author presents existing concepts to simulate complex systems and compares them with the new approach.

The Industrial Electronics Handbook, Second Edition combines traditional and newer, more specialized knowledge that will help industrial electronics engineers develop practical solutions for the design and implementation of high-power applications. Embracing the broad technological scope of the field, this collection explores fundamental areas, including analog and digital circuits, electronics, electromagnetic machines, signal processing, and industrial control and communications systems. It also facilitates the use of intelligent systems—such as neural networks, fuzzy systems, and evolutionary methods—in terms of a hierarchical structure that

makes factory control and supervision more efficient by addressing the needs of all production components. Enhancing its value, this fully updated collection presents research and global trends as published in the IEEE Transactions on Industrial Electronics Journal, one of the largest and most respected publications in the field. Control and Mechatronics presents concepts of control theory in a way that makes them easily understandable and practically useful for engineers or students working with control system applications. Focusing more on practical applications than on mathematics, this book avoids typical theorems and proofs and instead uses plain language and useful examples to: Concentrate on control system analysis and design, comparing various techniques Cover estimation, observation, and identification of the objects to be controlled—to ensure accurate system models before production Explore the various aspects of robotics and mechatronics Other volumes in the set: Fundamentals of Industrial Electronics Power Electronics and Motor Drives Industrial Communication Systems Intelligent Systems

This book constitutes the thoroughly refereed post-proceedings of the 5th IFIP WG 10.2 International Workshop on Software Technologies for Future Embedded and Ubiquitous Systems, SEUS 2007, held in conjunction with ISORC 2007, the 10th IEEE International Symposium on

Object/component/service-oriented Real-time Distributed Computing. Coverage includes ubiquitous computing frameworks, validation of embedded and ubiquitous systems, and ubiquitous computing applications.