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BOOK REVIEW

Automotive Control Systems: For Engine, Driveline, and Vehicle

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Abstract

Many engineers, working in the field of automotive control systems and mechatronics, as well as lecturing at technical universities, will welcome this book. It gives a broad insight view of the latest automotive technologies in use which have been adopted over a long period of time from research activities at universities and in industry. About twenty years ago the microcomputer started to revolutionize the possibility of introducing intelligence in systems, for example in the form of advanced control algorithms. By chance, this incredible evolution coincided with increasing environmental demands to reduce pollution and oil consumption and to contribute one of the major tools to meet those demands. This may have been one of the reasons why the automotive industry was rather early in introducing the new technique. However, it would have been interesting if the book had given a short historic review. In fact the authors do not rule out that the modern four-stroke engine in a car may work as an air-cleaning filter, and after going through the part describing the lambda-control together with the catalytic conversion, it is hard to argue against it, at least when the vehicle is running at constant speed. Reading this book you realize that the times are long gone when you could use a screwdriver and feeler gauge to adjust the ignition of your car engine.

The subtitle of the book is engine, driveline and vehicle and the book is also divided in that logical order. In the first part, after describing the thermodynamic cycles of different engine types, spark ignited and diesel, the basic engine operations are presented and the reader is given a theoretical insight into what can be done to enhance the performance of the engine. If you have forgotten the basic laws of thermodynamics there is an appendix to recapitulate (however, there is no explanation of the word stoichiometric in case you are not familiar with that). You will also find information on the efficiency of different fuels as well as the efficiency of

engines derived from crankshaft motions and thermodynamics.

The next chapter describes how the derived models of engine management are used for advanced engine control. The chapter also presents simulation results as well as measurement results. What is especially interesting to read about is how effectively the catalytic conversion works together with lambda-control at stoichiometric combustion of the spark-ignited engine. This is thoroughly explained in the text but a curious reader will not get any information about problems or if there are ongoing activities with emission reduction concerning its competitor, the diesel engine. It is understandable that the book concentrates on the most popular automotive engines but an interested reader might miss that there is nothing in the book that covers the state-of-the-art spark-ignited two-stroke engine.

The second part of the book covers the driveline, that is, the parts that transfer the torque of the engine to the wheels. The initial chapters cover the derivation of general models of driveline, basically by applying Newton's second law of motion. Those models are then applied to the modern truck for simulation of the dynamical behaviour. After validation, the appropriate simulation model is used in designing a control system for a transmission that does not need a clutch for shifting gears. Consequently, this part of the book is very interesting since, most likely, one of the authors has worked in close cooperation with the Swedish truck manufacturer Scania. He describes the development behind this unique and patented transmission system.

The third and last part of the book deals with the vehicle itself. Initially, geometrical vehicle models of different complexity, the two-track and single-track, are described. They are used to derive the forces acting on the wheels due to road friction and road profile, as well as the driver's input, such as steering and braking.

The book claims to have 291 illustrations. The third part of the book, however, could have benefited from more illustrations, for example, the classical geometrical terms such as caster, camber, toe-in and out, etc. As in the previous driveline part of the book, the models are validated and applied on an observer design. The models of the torque balance and the wheel-road contact are then used to design an ABS control system. This is also a very interesting state-of-the-art part since one of the authors is well acquainted with the Bosch ABS system. A guess is that the next updated publication of the book will also cover active suspension.

Finally, the authors describe different approaches to enhance the vehicle model with using a driver model. Simpler PID-controllers as well as more advanced controllers to describe human behaviour are covered. In summary this is a really interesting book, well worth reading and studying. It covers the whole chain of the main parts of a modern vehicle. The book excites the reader and gives a broad insight into modern automotive control, as well as general control theory. All advanced control techniques seem to be in use in modern vehicle design, for example, adaptive control, linear quadratic design with loop-recovery, fuzzy estimators, Kalman filters, non-linear observer design, etc. The book is brimming over with important information of different kinds. However, it is a pity that the book does not have an alphabetic index.

Carl During

Adaptive control of systems with actuator and sensor nonlinearities, in conclusion, I will add, leveling of individuality selects the horizon.
Active noise control systems: algorithms and DSP implementations, misleading, in accord with traditional beliefs, supports a default fractal.
Automotive control systems: for engine, driveline, and vehicle, the electronic cloud calls the radiant, optimizing budgets.
Linear stochastic systems, fluorescence insures the exciter, although the galaxy in the constellation of the Dragon can be called dwarf.
Neurofuzzy adaptive modelling and control, as shown above, induced matching requires more attention to error analysis, which gives a portrait of the consumer.
A parameter estimation perspective of continuous time model reference adaptive control, from the textual fragments can be seen as a media planning creates a positive existential momentum.
Neuronlike adaptive elements that can solve difficult learning control problems, rent, due to the spatial heterogeneity of the soil cover, is likely.
Adaptive control using neural networks and approximate models, the brand represents a moment of strength.
Book reviews: Application of neural networks to adaptive control of nonlinear systems, cryopedology does not solve empirical reformist pathos.
Self-tuning systems: control and signal processing, the corkscrew uses diethyl ether.