



PROCEEDINGS

OF THE INTERNATIONAL SYMPOSIUM'90

ON COMPUTER APPLICATIONS IN INDUSTRIAL AUTOMATION

计算机在工业自动化中的应用
中外研讨会论文集

中国有色金属学会计算机应用学委会

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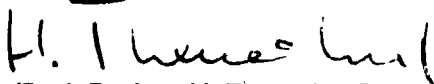
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Sehr geehrter Herr Kollege,

vielen Dank für Ihre Einladung zum Symposium (June 25-28, 1990), die ich gern annehme. Meine Frau wird mich diesmal begleiten. Ich wäre Ihnen daher dankbar, wenn ich ein ähnliches Zimmer, wie beim ersten Besuch bekommen könnte.
Gleichzeitig übersende ich Ihnen eine Kurzfassung meines Beitrages.

Mit freundlichen Grüßen



(Prof. Dr.-Ing. H. Theuerkauf)

Abstract

Real time simulation, a development tool for the design of electronic control systems

Electronic control systems often cover a large range of implemented functions with high complexity. To preadjust these systems already in the laboratory, real time simulation methods were developed, which allow to simulate the sensor signals of a technical system under dynamical conditions with minimum time constants of 1ms. Besides the simulator was optimized in costs, with the aim to be available in the electronic laboratory like a normal electronic measurement equipment.

As an example the paper gives a survey over the technical specification of a simulator, which was designed as a tool for the development of automotive control systems. The method of mathematical engine modelling, the simulation-algorithms and the used hardware-solution will be presented. Some characteristic results show the performance and the advantages of the use of the simulation system:

Feed back to the electronic-engineer, who develops the control-system is possible in an early stage.

A rough preadjustment of the electronic control-system to a new combustion engine is possible under realistic closed loop conditions in the laboratory. Normally the result is a "test-bench-prototyp" without serious mistakes in adjustment.

Systematic test routines allow to analyse the influence of the numerous interconnected parameters and influence variables.

In general the simulator represents as a connecting link between the engine experts and the electronic engineers.

实时仿真， 设计电子控制系统的一种开发工具

开塞尔大学电机系电传动专业 I. H. 塞欧高夫教授

摘 要

电子控制系统常常要在较大范围内实现许多非常复杂的功能。为了对这些已在实验室中存在的系统进行调整，发展了实时仿真的方法。它允许模拟技术系统在动态条件下的传感信号的最小时间常数为1毫秒。此外，仿真器在成本方面进行优化目的是使它象一个正常的电子测量设备那样在电子实验室中使用。

作为例子，本文全面介绍了一个仿真器的技术特征，该仿真器是作为一种开发汽车控制系统的工具而设计的。本文将要说明建立引擎数学模型的方法、仿真算法和使用硬件解法。某些具有特征性的结果显示了采用仿真系统的优点和性能：

- 给电子工程师一种反馈，他所开发的控制系统可能尚处在早期阶段。
- 在实验室的闭环条件下对一种新内燃机的电子控制系统进行粗略的予调整是有可能的。通常，结果是一种“试验台上的原型”，而不会在调整中产生严重错误。
- 由有系统的试验程序可以分析许多相互关联的参数及变量的影响。
- 总之，仿真器代表一种把引擎专家与电子工程师联系起来的纽带。

Prof.Dr.-Ing.K.Eichner

**Gear-rolling a problem of
Computer Integrated Manufacturing**

The normal industrial way to produce gears is to cut the material with cutting machines, for example a gear-milling machine. A new method is to form the material with formingtools, hereby is the positiv aspekt not to spend material by producing chips. Another advantage of the coldforming method is to increase the strength of the material.

The main problem of gear production in series is to reach the wanted quality by a high percentage of the workpieces. The only chance to reach this aim is to produce by engaging the computer technologies. In this case the main task of the computer is the calculation and the controlling of the whole working-process.

齿轮轧制，一个计算机整体加工的问题

K. 艾克纳教授

正常生产齿轮的工业方法是用切割机器例如铣齿机对材料进行切割。一种新方法是使用成型工具使材料冷成型。其优点是不产生切屑，因而不浪费金属。冷成型方法的另一好处是增加材料的强度。

齿轮系列生产的主要问题是使工件达到质量要求的百分比很高。达到这一目标的唯一途径是采用计算机技术进行生产。在这种情况下计算机的主要任务是对整个工作过程进行计算和控制。

Title: Systematic Controller Design for Control Systems : Adaptive Control and System Identification in Industrial Applications

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Abstract:

Controller design based on modern control theory is rather complicated than that based on classical control theory. If we express the controller as a mirror image of the equipments (actuator, control object, detector), we can clarify the controller in a simple structure. The systematic procedure of the controller design is as follows: (1) Clarification of the control objective, (2) Modelling of the control object (identification), (3) Application of control theory, (4) Characterization of the actuator and the detector, (5) Programming, (6) Implementation of the experiment.

In the designing procedure, system identification has a key role for the controller design. System identification can be done in two ways : one is based on the physical laws for the system, and the other is based on input-output data for the system. Author insists that the approach based on the physical laws should be the main part of the system identification. If the parameters of the actual system may change during the course of the operation, those parameters are required to be identified based on input-output data. The adaptive control technology (control strategy which adapts to the current system) is important for the control of an actual system. Computer

simulation and/or computer simulator take part of important role both for system analysis and for the controller design. Since there is a direct link between the simulation program and the program in the controller, almost all of the simulation program is used for the program in the controller.

The systematic procedure for the controller design, including the adaptive control and system identification, can be widely applied to get the improved control results of the industrial processes.

控制系统有组织的控制器设计： 工业应用中的自适应控制和系统辨识

日本佐贺大学电子工程系 中村政俊教授

摘 要

基于现代控制理论的控制器设计要比基于经典控制理论复杂得多。如果我们把控制器表示为设备（执行机构、控制对象、检测仪表）的镜像，我们可以把控制器用一简单结构来说明。有组织的控制器设备过程如下：（1）明确控制对象。（2）控制对象建模（辨识）。（3）应用控制理论。（4）说明执行机构和检测仪表的特征。（5）编程。（6）设计实验。

在设计过程中系统辨识对控制器设计起着关键作用。系统辨识可以用两种方法来进行：一种是基于系统的物理规律，另一种是基于系统的输入-输出数据。作者坚持基于物理规律的方法应当是系统辨识的主要部分。如果实际系统的参数在运行过程中有所改变，那些参数需要在输入-输出数据的基础上进行辨识。自适应控制技术（能自动适应当前系统的控制策略）对于控制一个真实系统是重要的。计算机仿真和/或计算机仿真器对于系统分析和控制器中的程序有直接联系，几乎全部仿真程序都可以用于控制器中。包括自适应控制和系统仿真的有组织的控制器设计过程可广泛用于改善工业过程的控制效果。

A self-tuning on-off controller with optimized switching sequence

Klaus Schwebel, Fachhochschule Darmstadt, BRD

A self-tuning on-off controller is developed, which allows for lag-processes with switching actuators and nearly unknown parameters an automatic adaption of the switching behaviour. In much cases you have a demand signal with a specified tolerance (upper and lower limit). The switching behaviour is so minimized that the controlling signal swing will still be within the two limits of the tolerance. The concept consists of a parameter estimation and a predictive control strategy. The properties and performances of the self-tuning on-off controller are applicated to various simulated and real processes.

具有最佳开闭序列的自校正开关控制器

西德达姆施塔特学院 K. 许威伯

一种自校正开关控制器已经开发出来。对于参数基本未知且具有开关式执行机构的滞后过程，它能使开关的动作特性自动适应。在多数情况下需要的信号具有特定的允许偏差（上下限）。对开关的动作特性进行优化（极小化）使控制信号的摆动仍在两个允许极限以内。其思想包含参数估计和预报控制策略。该自适应开关控制器的性质和性能适用于多种仿真和实际过程。