An exhibition that has yet to be

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An Exhibition that has yet to be

Günther Schmidt and Christopher Bissell

Winfried Oppelt was one of the great pioneers of German control engineering. For those who wish to find out more about his professional life, information is given in [1, 2, and 3]; some milestones are also listed in Table 1. This short article, however, is concerned with his proposal, which was never realised, for a special permanent exhibition of control engineering in the great German museum of science and technology, the Deutsches Museum in Munich. The article is based on the more detailed German account in [4]. Readers who would like to know more about Oppelt's proposal are referred to this – even those who do not read German will find a wealth of interest in the remaining six of of his hand-drawn illustrations which it has not been possible to reproduce in this short 'Historical Perspectives' section of Control Systems Magazine.

1912	Born on 5 June in Hanau
1934	Graduated from *Darmstadt Technical University*, joined *Deutsche Versuchsanstalt für Luftfahrt* [German Aviation Research Institute]
1937	Left DVL for *Anschütz* in Kiel; published seminal paper on flight control
1939-1944	Member of VDI committee on automatic control chaired by Hermann Schmidt
1942	Became head of a *Siemens* research department in Berlin
1943	Doctorate awarded by *Darmstadt Technical University*

1945	Joined *Brunswick Technical University*
1947	*Grundgesetze der Regelung* [Basic Laws of Control] appeared
1949	Joined *Hartmann & Braun* in Frankfurt; *Stetige Regelvorgänge* [Continuous Control Processes] appeared
1952	Part-time teaching at *Darmstadt Technical University*
1954	*Kleines Handbuch technischer Regelvorgänge* [Short Handbook of technical Control Processes] appeared
1957	Professor of Automatic Control, Darmstadt
1967	Elected Fellow of IEEE
1971	Awarded VDI *Grashof-Denkmünze* prize
1977	Retired
1980	Awarded Austrian *Wilhelm-Exner-Medaille*
1981	Awarded GAIRN EEC Medal of London Society of Engineers
1982	Awarded *Aachener und Münchner Preis*
1999	Died on October 4 aged 87

Table 1. Some milestones in the life of Winfried Oppelt

Oppelt was a renowned engineering educator, and one of the most engaging features of his early teaching texts was the use he made of his own hand drawings to illustrate technical points. So it is not surprising that he employed his skills as a draftsman in his proposal to Deutsches Museum in 1972.

Figure 1 shows Oppelt's overall concept of the exhibition – clearly a large scale proposal in which the visitor would be led through a series of connected rooms demonstrating the principles of feedback control, the major application areas, aspects of the historical

development of the discipline, and simulations to enable visitors to try their hand at controlling a plant.

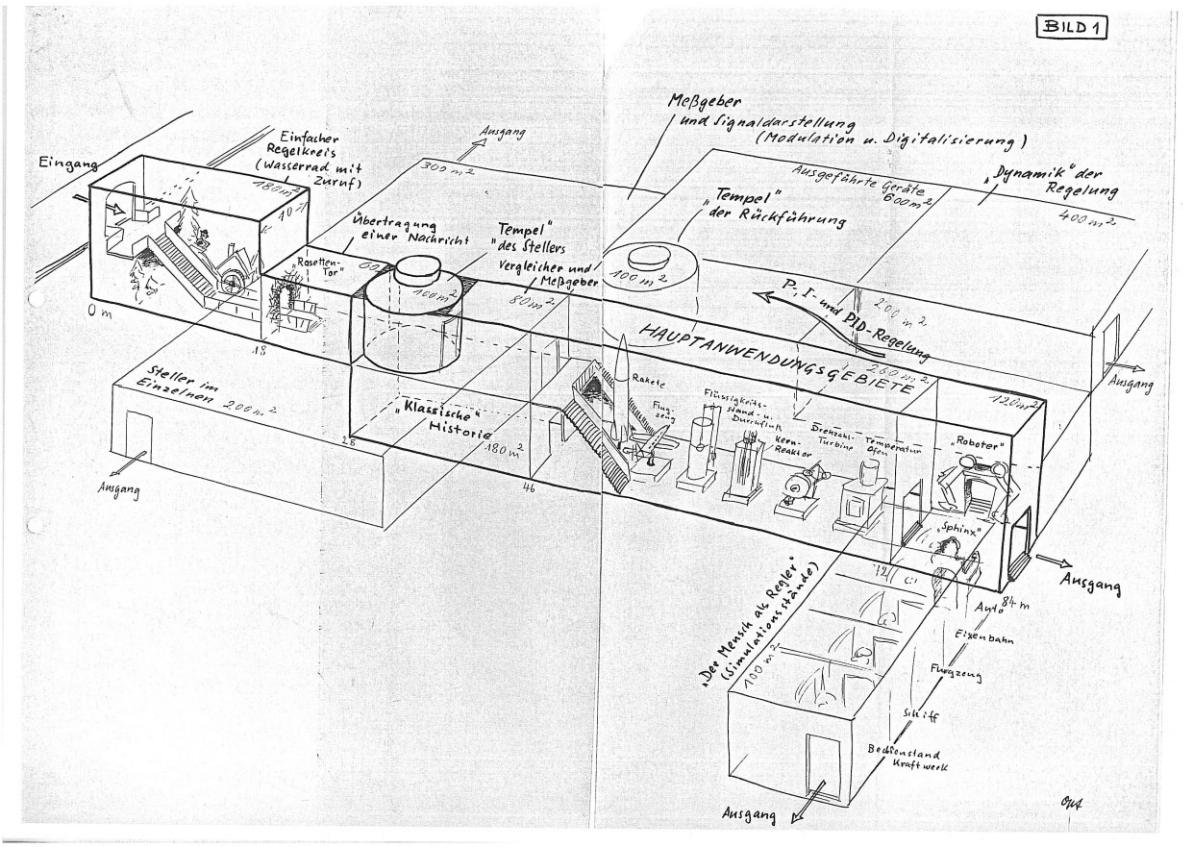

Figure 1. The overall concept of an exhibition devoted to automatic control

The first room is shown in Figure 2. A waterwheel is powering a saw. Mechanical, moving figures represent the person sawing and the person controlling the water supply to the mill, and the feedback is provided by calls of “more water”, “less water” or “steady as she goes” from the saw operator to the controller. Illuminated displays on the wall link this tableau to the notion of a feedback loop, including the notion of signal flow.

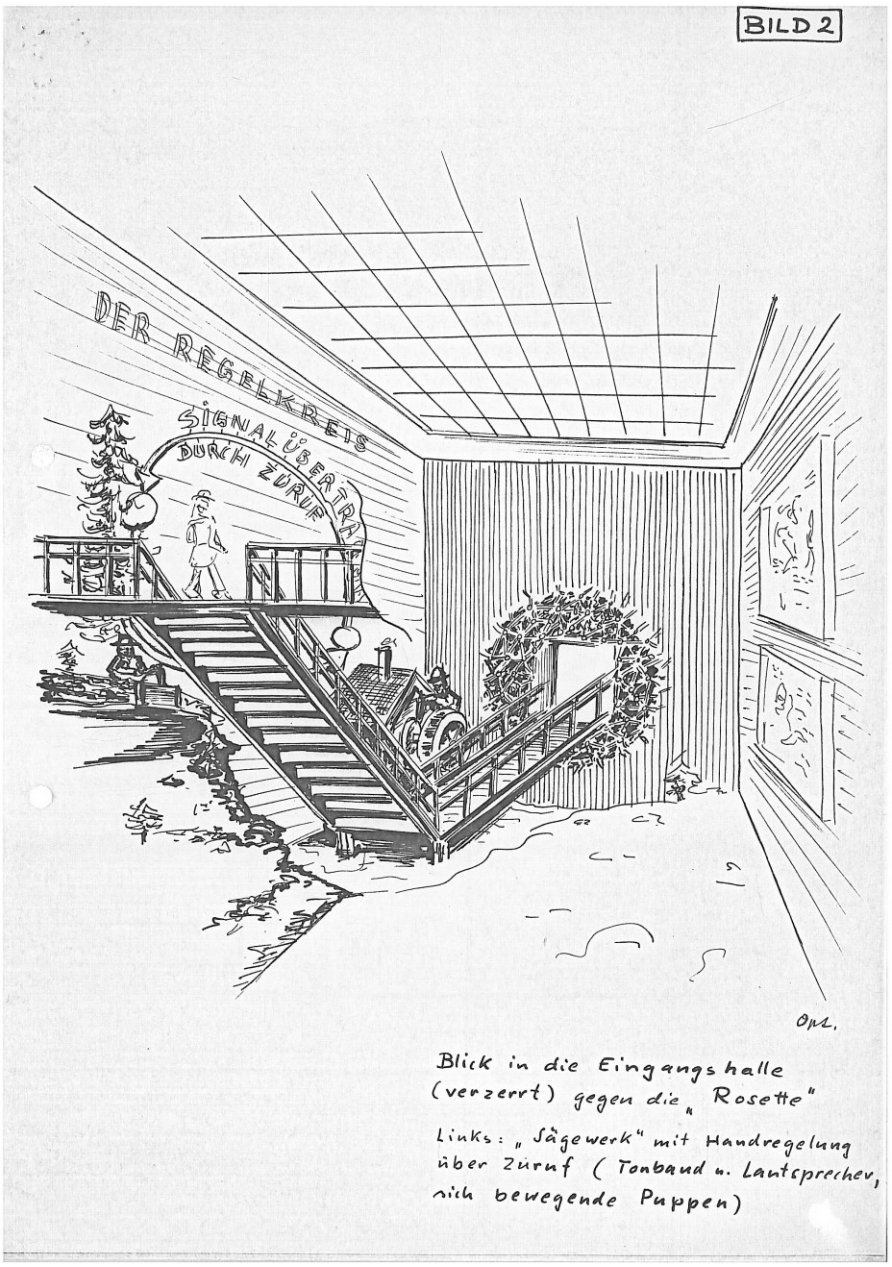

Figure 2. The first proposed room. The concept of feedback control is presented with the aid of a waterwheel example.

Subsequently, following another two rooms demonstrating first signal transmission and then what Oppelt called the "Temple of the Actuator" (where various ways of using a signal to control a physical variable are demonstrated), the visitor comes to a display of application areas in rocketry, fluid level and flow control, nuclear reactor and temperature control, and so on, as shown in Figure 3.

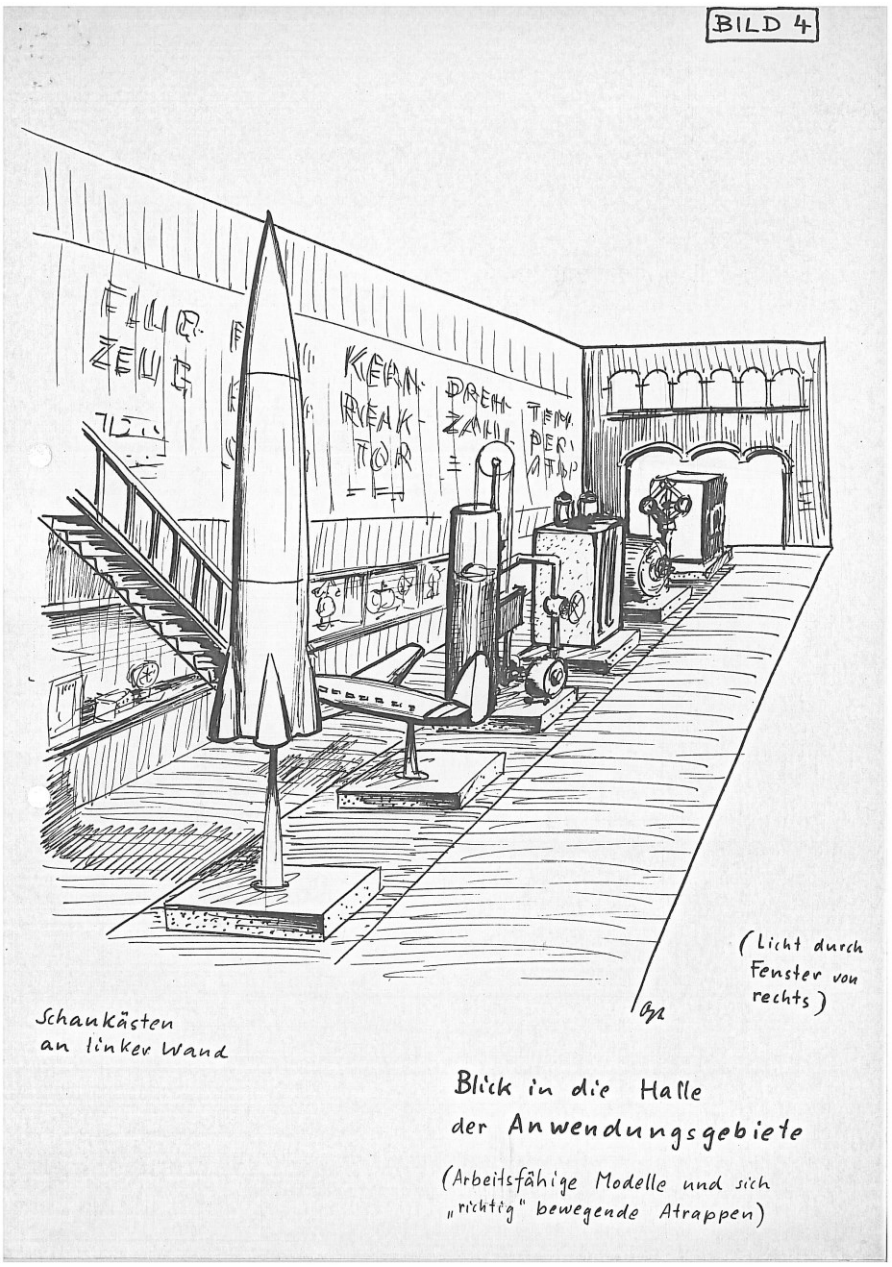

Figure 3. A variety of applications. Exhibits were to cover control systems from level control to rocketry.

Oppelt was keen for visitors to have “hands-on” experiences with simulations – and we are talking of a period some time before the PC and screen-based simulations! Figure 4, for example, shows his proposal for a ship-steering simulation, but in addition he had in mind hands-on simulations of car, rail, aircraft and power plant control!

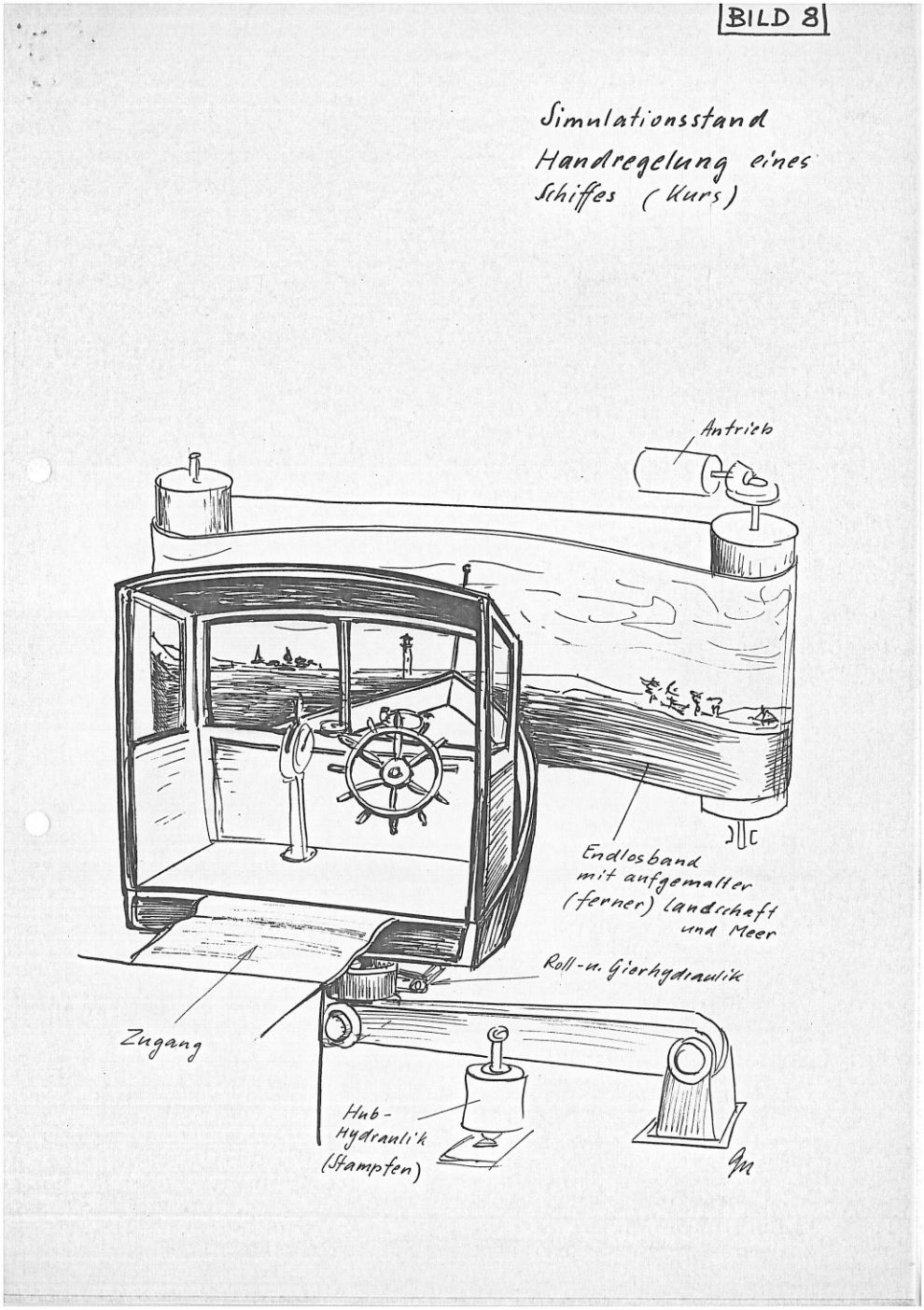

Figure 4. Simulation, simulation. Oppelt wanted visitors to get the hands-on experience of controlling dynamic systems

He also wanted to explain and demonstrate some of the more theoretical concepts of feedback control, so one of the rooms near the end of the exhibition was to demonstrate the effect of

proportional, integral, PI and PID controllers on a system for regulating liquid level (Figure 5).

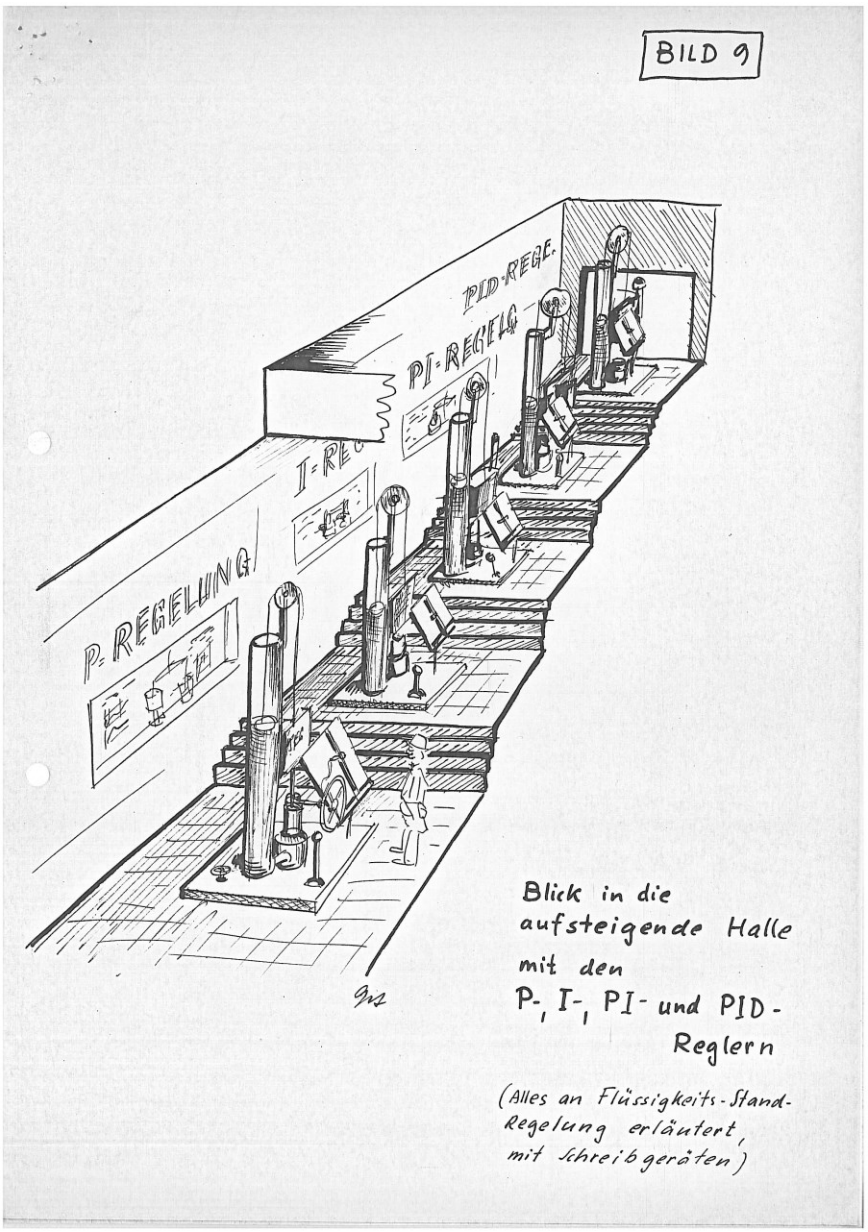

Figure 5. Three term control in stages. The exhibition was to introduce visitors into some of the basic concepts of control engineering.

Further exhibits were to be devoted to the implementation of feedback systems using mechanical, electrical or pneumatic devices; sensors and signal representation; control system dynamics and stability; and so on. An explicitly historical room would include classic

examples such as level control systems from the ancient world (Hero of Alexandria and Ktesibios), the Watt governor, Farcot's servo-motor, and so on.

Overall, then, a very ambitious proposal, particularly for a subject area that is generally 'hidden' from the lay person – in contrast to technologies such as computers, aircraft, automobiles, steam engines, or even clocks and other small mechanisms, which tend to take pride of place in museums of technology.

Oppelt submitted his proposal in September 1972. It was taken very seriously by the Museum, and a committee was established in 1974 to examine it further; the committee included museum staff and members from academia, but also participants from industry. The original proposal soon ran into difficulties. Its ambitious size was too much for the available museum space – but the proposal was also considered in other respects to be too *restricted* in scope. Oppelt had tried to present the essentials of feedback control to a lay audience, but had thus omitted many important contemporary areas of automation and control. Even in the early 1970s, multivariable systems, digital data, and computer control were becoming extremely important. By 1976-7 a revised proposal was made to broaden the scope to include more 'cybernetic' areas, such as control notions in economics, ecology and society. There was considerable support from industrial sponsors, institutes and individuals, offers of assistance with the construction of interactive exhibits and displays, and even the donation of historical and contemporary artefacts. Ultimately, however, the construction of a new section devoted to control could not be financed. In spite of a further attempt to revive the project in the mid 1980s, the project for a large-scale, specialised exhibition on automation and control at the Deutsches Museum was eventually abandoned. It is interesting to note that at the time of the final proposal, Otto Mayr, one of the foremost historians of control engineering [5], had

recently taken on the post of Director. Nevertheless, the control proposal lost out to the needs of computing and IT displays.

One of the problems of trying to include a significant control engineering presence in museums of science and technology is that there are so many competing areas, and by the late 1970s and 1980s computing took priority in many such museums. Control engineering – or, rather, automation – was thus likely at best to achieve a supporting role in larger exhibitions on the development of the digital computer. To this day, then, it can be argued that control engineering is under-represented in the major international museums of science and technology, given the importance of the discipline in almost every aspect of modern life. Perhaps there is thus an important role for increased liaison and communication between the various technical societies concerned with control engineering, and the major museums of science and technology, in order to redress the balance.

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Günther Schmidt is Professor Emeritus at TU München. Around fifty years ago he gained his doctorate at Darmstadt under the supervision of Winfried Oppelt. From 1993 to 2002 he was Editor of the German control engineering journal **at**-*Automatisierungstechnik*.

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