

# Control and Cybernetics

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## The Moving Frontier Questionnaire

response by

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*1. What kind of problems are you currently working on ?*

My current research interest lies in the areas of hierarchical decision making and control under uncertainty. In particular, problems related to properties and implementation of coordination techniques for uncertain — e.g. stochastic — optimization of complex systems are considered. Control under uncertainty forms the most interesting and important group of research problems. Practical, i.e. implementable, design techniques for optimizing supervisory control have to be developed and investigated.

*2. What problems do you think are the most important to solve in your domain in the nearest future ?*

The essential group of problems which have to be addressed in the nearest future concerns methods of computer aided analysis and design of structures and algorithms for both regulatory and optimizing (supervisory) control of non-linear systems under the presence of uncertainty. The undeniable fact is that

the modern computer technology is rapidly changing and expanding the class of control algorithms – making it in particular possible to implement regulatory and optimizing control based upon repetitive optimization of nonlinear systems and even allowing for on-line repetitive simplified closed-loop control design. Such control/management schemes cannot be analyzed in a classical sense with the use of mathematical analytical methods. New techniques of analysis based upon the use of computer based simulation are required and have to be developed. This offers a considerable challenge to scientific community and creates need for specialists having expert knowledge of both control techniques and advanced computer programming. Process of control design will have to be based upon the use of engineering expertise and modern mathematical techniques. It can easily be envisaged that the use of distributed computing and computer networks will have to be made for the described purpose.

*3. Which of the recent applications of scientific results from your domain do you consider as most interesting ?*

From my own domain of control and decision making under uncertainty I consider as a very interesting indeed the results which have been obtained by us on control of retention reservoirs during flood period, where a successful control structure has to involve a number of decision units, algorithms working at different time scales and levels and where it is necessary to account for a very large level of uncertainty with respect to external inputs. Analysis of control algorithms requires extensive computer simulations with the use of scenario and forecast generation and with human-computer interactions.

As far as other applications of control techniques for control under uncertainty are concerned I would like to mention rapidly expanding use of long range predictive control algorithms for regulation and the use of optimization techniques for on-line management.

*4. To what extent is availability of definite computer hardware influencing your scientific work ?*

Availability of vastly improved and relatively cheap computer hardware and software is obviously influencing most of the scientific work in the domain of decision making and control. In fact it is the rapid development and proliferation of the computer hardware which changes the basic attitude of a control scientist to approaching the research problems – the paper-based formal mathematical analysis is being replaced with the use of engineering expertise and powerful

computer based tools for design and simulation. In a certain way the old days are back again - with a sliding rule exchanged for a computer workstation on the same desk.

of the fact that a certain number of cases of this disease are now being reported from the United States.

— (Continued)