Announcing the Antonio Ruberti Young Researcher Prize

On behalf of the IEEE Control Systems Society (CSS), I am pleased to announce the creation of a new CSS Award, the Antonio Ruberti Young Researcher Prize, made possible through the generous support of the Antonio Ruberti Foundation of Rome, Italy. The Ruberti Prize is an annual award intended to recognize distinguished cutting-edge contributions to the theory or application of systems and control by a young researcher. The award honors the memory of Antonio Ruberti and his lifelong accomplishments to control technology and society, with the intent of awarding a new generation of engineers: meeting human needs through a multidisciplinary path from complex systems to technological innovation

To be eligible, the awardee must be 40 years old or younger on 1 January of the year of the award. The Ruberti Prize consists of US$5,000, a plaque, and certificate, plus nominal expenses for attending the Conference on Decision and Control (CDC). The first recipient of the Ruberti Prize will be announced at the Joint Conference on Decision and Control and European Control Conference in Seville, Spain, on 14 December.

Antonio Ruberti was one of the first three professors of automatic control in Italy (together with Giorgio Quazza and Antonio Lepschy). In 1964, the first chair of automatic control was established at the University of Rome "La Sapienza," and Prof. Ruberti was hired and appointed to that position. Prof. Ruberti was faculty dean and later rector (for 11 years) of "La Sapienza," minister of the Scientific Research, commissioner of the EU for Science and Research. He subsequently held several other positions in the EU Commission until his sudden and unexpected death in 2000. The remainder of this article provides more information about Prof. Ruberti's distinguished career.

On behalf of the CSS, I am extremely grateful to the Antonio Ruberti Foundation for its generosity in establishing this award. I would also like to thank Prof. Lorenzo Farina, associate professor at the Department of Computer and Systems Science "A. Ruberti" of the University of Rome, "La Sapienza," and Elena Valcher, incoming CSS vice-president for member activities, for their help in establishing this award.

—Mark W. Spong
CSS President

Designing large-scale technologies presents a twofold challenge to engineers: manage the inherent complexity through a multidisciplinary mindset and anticipate the environmental and social implications.

The year was 1971, and Antonio Ruberti was giving his keynote address for the opening of the academic semester. He knew that to meet such a grand challenge, an entire new generation of engineers would be needed. How could this goal be reached? The answer is precisely where the many aspects of complex systems engineering come into play.

Complex systems engineering challenges have existed since the day engineers began undertaking projects too large for a single craftsman. These projects call for teams of engineers organized and directed toward a common goal. Recent decades have witnessed an impressive increase in large-scale engineering projects so that, today, technical complexity is the rule rather than the exception. The peculiarity of the complex system engineer lies in an integrated approach to the study of real-world problems through the analysis of information flows and control processes, all the while recognizing the pervasiveness of an underlying structure that establishes an ordered relationship among the various parts of the system. Recognizing such structure and relationships is a formidable task.

The field of action of a complex systems engineer is not enclosed by technological fences: the horizon of potential applications is constantly expanding and new frontiers are appearing. An exciting future for the bravest.

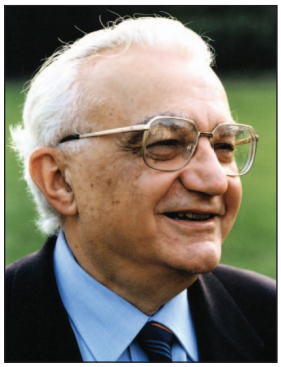
Dealing successfully with a broad range of applications can be an overwhelming task for a single engineer since in-depth knowledge of the physical, biological, chemical, and economic layers of complex systems is often required. The key to success can be found in an effective multidisciplinary partnership focused on developing a common language and basic set of notions. Although mathematics plays the role of lingua franca, a wide variety of mathematical tools may be needed, including new tools for specialized purposes. This partnership is the only way to make technological innovations a reality. According to this view, curricula should be strongly multidisciplinary.

Training a new generation of engineers calls for a deep change in engineering education: we need much more than basic math and physics or

chemistry, we do need also basics of biology and economy. The future complex system engineer must experience the excitement of systems knowledge in action on working applications.

The world of 2005 is a very different place than the world of the early 1970s, when Antonio Ruberti gave his keynote speech. Yet, his anticipatory vision is still with us; responding to his challenge keeps his ideas and enthusiasm alive and vibrant.

—Lorenzo Farina
Associate Professor of Systems Theory
Department of Computer and Systems Science
"Antonio Ruberti"
University of Rome "La Sapienza," Italy



Antonio Ruberti, prominent control theorist, university president, and member of the Italian Parliament. The Antonio Ruberti Young Research Prize is named and supported in his memory.

Antonio Ruberti (1927–2000)

Antonio Ruberti graduated in electrical engineering from the University of Naples "Federico II," Italy. He began his career as a researcher at the Ugo Bordoni Foundation in 1954. He became a professor of automatic control at the University of Rome "La Sapienza" in 1962 and became a professor of systems theory in 1973.

The scientific focus of Antonio Ruberti's research was in systems and control, documented by more than 80 scientific papers. His interests were so broad and his contributions so pervasive that it is hopeless to describe his works in a short biographical note. We will therefore mention a few of Ruberti's papers to highlight his major interests and achievements.

During the 1960s, Prof. Ruberti was interested primarily in frequency-domain methods. He developed a practical rule for applying the Nyquist criterion directly to Bode plots [1] and used the describing function method to analyze sampled-data control systems with piecewise nonlinearities [2]. He was also interested in analog computing and designed electronic devices for bidimensional signals [3] and white noise generators [4].

During the 1970s, Prof. Ruberti worked in the area of systems theory. He developed a factorization method for the impulse response matrix [5], and he extended the Kalman canonical decomposition to time-varying systems [6], for which he was awarded best paper of the year. He also explored the relationships between state-space representations and realizations [7], [8]. In the 1980s, he worked on nonlinear systems, first developing a realization theory for bilinear systems [9] and then showing the link between state-space representations and the kernels of the Volterra series [10]. Finally, he pioneered the study of nonlinear systems and feedback linearization [11]. The results obtained were so fundamental that, for his contribution to the field of nonlinear geometric theory and applications, he was nominated an IEEE Fellow in 1985.

Prof. Ruberti received many international awards and recognitions, including the IEEE Centennial Medal, the European Leonardo Award, and the Docteur honoris causa in applied sciences from the Catholic University of Louvain.

The impact of Prof. Ruberti on the Italian scientific and technological cultural milieu was cross cutting, deep, and long lasting. He founded and directed (1969–1976) the Institute of Automatic Control (now the Department of Computer and Systems Science "Antonio Ruberti") at the University of Rome "La Sapienza" as well as the Center for Control Systems and Automatic Computation (now the Institute for System Analysis and Computer Science "Antonio Ruberti") of the National Research Council, the first Italian research centers in the area of systems and information sciences. Under Prof. Ruberti's directorship both of these organizations became prestigious international research centers.

Prof. Ruberti was dean of the Faculty of Engineering (1973–1976) and president of the University "La Sapienza" (1976–1987), one of the oldest (founded by Pope Boniface

Antonio Ruberti during a visit to IBM in Poughkeepsie, New York, in 1959. Seated (from left) are Antonio Lepschy, Istituto Superiore delle Telecomunicazioni, Italy, and Giuseppe Evangelisti, University of Bologna, Italy. Standing (from left) are G. Simons, manager of Unit Records Systems, IBM World Trade Corporation, and Antonio Ruberti, Istituto Superiore delle Telecomunicazioni, Italy.

(continued on page 134)

new algorithms. Since its inception, QFT has been extended and generalized to cover MIMO LTI systems, time-varying systems, and classes of uncertain nonlinear systems. Numerous impressive real-world applications of the method have been published. There have been technical sessions dedicated to QFT, and several symposia have been held on the subject.

Prof. Horowitz was an IEEE Fellow (1970), and he received the ASME Rufus Oldenburger Medal for seminal contributions in feedback control (1992). Several textbooks have appeared on QFT, and the subject is taught at the graduate and undergraduate levels at universities around the world. Software packages, including a MATLAB QFT Toolbox, appeared in the early 1990s to carry out practical designs using QFT ideas and quickly found a strong following in industry. One might say that Prof. Horowitz's QFT is a useful tool in the toolbox of the control engineer.

Prof. Isaac Horowitz made a lifetime of contributions to the practice and theory of robust control and significantly changed the course of the controls field. The control community will miss him.

Acknowledgments

In preparing this document, we consulted numerous people who knew Prof. Horowitz at different stages in his life. We attempted to convey their personal accounts in their own language; any errors or omissions are solely our oversight. Any opinions expressed otherwise are ours and may not represent the views of those we consulted. We wish to thank everyone who contributed for their generous support.

References

[1] I. Horowitz, *Synthesis of Feedback Systems*. New York: Academic, 1963.

[2] I. Horowitz, *Quantitative Feedback Design Theory (QFT)*, vol. 1.QFT Publications, 1993.

[3] I. Horowitz and M. Sidi, "Synthesis of feedback systems for prescribed time-domain tolerances," *Int. J. Contr.*, vol. 16, no. 2, pp. 287–309, 1972.

Y. Chait was introduced to Prof. Horowitz in the early 1990s by Oded Yaniv, Chait's QFT teacher.

S. Jayasuriya came to know Prof. Horowitz in 1982 through his advisor Robert Barnard, who had worked closely with Isaac in the late 70s.

CSS News *(continued from page 125)*

VIII in 1303) and largest European universities, with over 100,000 students.

Prof. Ruberti was minister of Coordination of Scientific and Technological Research in the Italian Government (1987–1989) and, subsequently, minister of University and of Scientific and Technological Research (1989–1992). He promoted laws to renew the Italian system of education and training and launched innovative research programs aimed at new materials, bioelectronics, and the environment. In 1988, he instituted the Italian Space Agency and, in 1992, founded the third University of Rome.

Prof. Ruberti was the European Commissioner for Science, Research and Development, and Education (1993–1995). A European research program (4th Program Framework) for US$13 billion was launched under his leadership, along with new education and training initiatives, including the Socrates and Leonardo programs. He also undertook initiatives to promote public understanding of science through the European Forum on Science and Technology.

In 1996, Prof. Ruberti was elected to the Italian Parliament as a member of the Democratic Party of the Left. In Parliament, he chaired the Committee on European Union Policies contributing to the European integration process.

Prof. Ruberti published numerous essays and articles on the politics of research, education, and the problems of technological innovation. He edited two books, *Technology Tomorrow* and *Europe Confronted,* published in 1985 and 1990, respectively. In 1995 he published, with M. André, *Un Espace Européen de la Science*.

References

[1] A. Lepschy and A. Ruberti, "A rule for direct verification of the Nyquist criterion in non-polar diagrams," in *Proc. 1st IFAC Congress*, Moscow, 1960, pp. J1–J4.

[2] A. Lepschy and A. Ruberti, "The describing function for the study of sample-data control systems with a piece-wise nonlinearity," *Alta Frequenza*, vol. 32, no. 5, pp. 85–93, 1963.

[3] M. Petternella and A. Ruberti, "A diode generator of functions of two variables," *Annales de l'Association International pour le Calcul Analogique*, no. 1, pp. 1–7, 1961.

[4] M. Petternella and A. Ruberti, "Un generatore di rumore bianco a bassa frequenza con sorgente artificiale," *Alta Frequenza*, vol. 33, no. 6, pp. 376–386, 1964.

[5] C. Bruni, A. Isidori, and A. Ruberti, "A method of factorization of the impulse response matrix," *IEEE Trans. Automat. Contr.*, vol. AC-13, no. 6, pp. 739–741, 1968.

[6] P. D'Alessandro, A. Isidori, and A. Ruberti, "A new approach to the theory of canonical decomposition of linear dynamical systems," *SIAM J. Contr.*, vol. 11, no. 1, pp. 148–158, 1973.

[7] A. Isidori and A. Ruberti, "State-space representation and realization of time-varying linear input-output functions," *J. Franklin Inst.*, vol. 301, no. 6, pp. 573–592.

[8] A. Isidori and A. Ruberti, "State-space representation versus realization in system theory," *J. Franklin Inst.*, vol. 309, no. 5, pp. 281–286.

[9] P. D'Alessandro, A. Isidori, and A. Ruberti, "Realization and structure theory of bilinear dynamical systems," *SIAM J. Contr.*, vol. 12, no. 3, pp. 517–535, 1974.

[10] A. Isidori and A. Ruberti, "A separation property of realizable Volterra kernels," *Syst. Contr. Lett.*, vol. 1, no. 5, pp. 309–311, 1982.

[11] A. Isidori and A. Ruberti, "On the synthesis of linear input-output responses for nonlinear systems," *Syst. Contr. Lett.*, vol. 4, no. 1, pp. 17–22, 1984.