# 1   Obituary to A. J. Pritchard[1]

On the 12th of August 2007 Tony Pritchard, professor of mathematics at the University of Warwick, died suddenly at the age of 70 from a heart attack while on holiday with his family on the island of Lanzarote.

Both of the authors have had the privilege of working with him for many years. We have lost both a colleague and a friend and the following notes are dedicated to his memory.
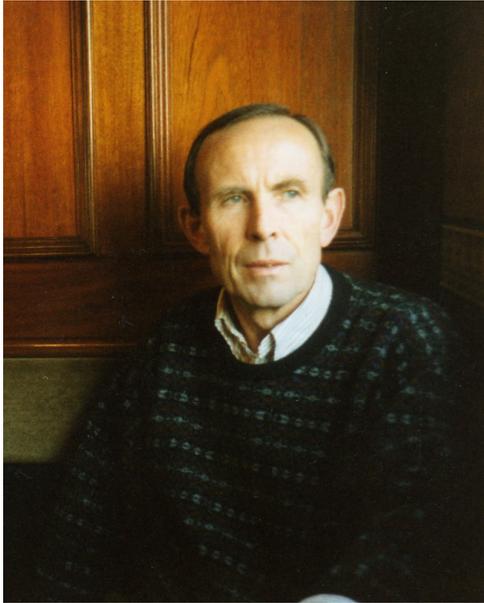
1.1   A. J. Pritchard: biographical notes[2]

Anthony J. Pritchard was born on 5th March 1937 in Pontypridd in South Wales. Although most of his upbringing and all his school education was in Bristol, England, he always regarded himself as Welsh. This feeling was reinforced when, during his university days in London, he paired up for life

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with Buddug, who was born in the same year in Denbighshire, North Wales, and spoke Welsh fluently. He took a B.Sc. degree in mathematics at Kings College, London in 1958. After only a year as a Ph.D. student at Imperial College, he became the proud father of a baby daughter Sîan. His new financial responsibilities dictated that he leave in 1959 with a Diploma of Imperial College to take up a teaching post at Filton high school in Bristol. By 1964 three more daughters Catrin, Rhian and Ceri, had been born in quick succession, resulting in a bevy of 4 girls under the age of 5.

In September 1966 he was appointed as a lecturer at the Department of Mathematics, Rugby College of Engineering Technology, which gave him the opportunity to take up mathematics once again. Under the supervision of Patrick Parks, he started on a Ph.D. in applied mathematics at the new university of Warwick and soon after, in September 1968, recognizing his scientific strength the founding professor of engineering, Arthur Shercliff, appointed him to the post of lecturer in the engineering department.

The founding professor of mathematics, Christopher Zeeman, decreed that applied mathematicians did not belong in the mathematics department, but close to the applications of mathematics. So the applied mathematicians were distributed between the engineering and physics departments. Following an enquiry into the state of applied mathematics in the UK by the Royal Society, Larry Markus and Patrick Parks submitted a proposal to the SERC to set up a Control Theory Centre at the University of Warwick within the Schools of Mathematics and Engineering Science. The aim was to stimulate research and study among British scientists of the mathematical and theoretical aspects of control science. The proposal was successful and in 1970 the Control Theory Centre was born. The three founding members were the director, Larry Markus (professor of mathematics at the university of Minnesota and the university of Warwick), the assistant director, Patrick Parks, and Tony. In 1971 the first research fellows, David Wishart and Ruth Curtain, were appointed and in addition, there were funds for visitors and for an annual conference. The first in 1971 was the "IMA Conference on Control of Systems described by Partial Differential Equations". This relatively new research area was to be the central theme of the Control Theory Centre with Tony as the main catalyst. Since Larry Markus only spent the summer at the University of Warwick, much of the administration was carried out by Patrick and Tony. In 1974 Larry passed the directorship on to Patrick Parks and in 1976 Tony took over the directorship. The centre developed rapidly into one of the main hubs of research in control theory in the UK

and attracted international experts to the annual conferences and as summer visitors. However, its international recognition stemmed from the "Infinite Dimensional Linear Systems Theory" approach to analyzing the control of partial and delay differential equations. In particular, the monograph bearing that title [B4] (jointly authored by Tony and Ruth Curtain) became the calling card of the centre.

The location of the Control Theory Centre in a specially built penthouse on top of the engineering building helped to create a close-knit group. The atmosphere was stimulating intellectually and at the same time supportive and friendly with regular social evenings at the homes of the members. Tony was actively involved in the research and social activities of the research fellows and he supervised several Ph.D. students in the area of control of partial differential equations. Under his leadership research collaboration with Rome and Toulouse were initiated in 1977.

As a result of these collaborations international visitors were regularly on the scene in the Control Theory Centre, so creating an ideal intellectual climate for the Ph.D. students and research fellows. Many of the early research fellows David Wishart, Ruth Curtain, Roberto Triggiani, Andrew Plant, Andrew Wirth, Akira Ichikawa, Eugene Ryan, Jerzy Zabczyk, Steve Banks went on to be professors in the UK and overseas. On the national level the Control Theory Centre promoted the use of functional analysis in control engineering by giving a number of short courses on the subject (see also the book [B5]).

In 1976 Tony and Ruth Curtain were invited by Diederich Hinrichsen to present their approach to infinite dimensional systems theory in a lecture series at the University of Bremen. This was the beginning of a collaboration that lasted more than thirty years. A first joint project financed by the EEC was a teaching project and resulted in Lecture Notes for a joint introductory course on *Mathematical Systems Theory* at the Universities of Warwick and Bremen, 1977-79. After Ruth Curtain moved to the University of Groningen in 1977 Peter Crouch joined the Control Theory Centre. In 1980 the collaboration was extended to the University of Groningen with the aim of setting up joint advanced lecture courses on control. The financial support of the EEC facilitated several exchange visits of staff and doctoral students between the universities and the organization of joint workshops in Edzell, Scotland, 1980 and 1981, which were attended by leading systems theorists from Europe and Israel.

After the end of the EEC funded teaching projects, Tony and Diederich

Hinrichsen continued their collaboration and began to pursue the project of writing a comprehensive textbook on mathematical systems theory based on the lecture notes developed earlier. Long term exchange visits during the years 1983-85 were made possible by the financial support of the universities of Bremen and Warwick, and by funds of the SERC. Out of this collaboration the second main research theme in Tony's career emerged, "Robust stability and robust control". The research was supported by two grants of the European Community, the first one (1986-90) obtained jointly with Ruth Curtain (Groningen) and the second (1991-94) jointly with Ruth Curtain and Jan Willems (Groningen). Apart from the direct benefits for the research of the three groups these European projects had two important side-effects for each of them. Firstly, it enabled them to purchase a workstation which, for the first time, made experimental work possible and also greatly enhanced the communication between them via email. Secondly, it facilitated an exchange of ideas and personal contacts among the doctoral students and postdocs during the frequent short term exchange visits between the three groups, the annual workshops and additional conferences. Usually the workshops took place in quiet hotels in the Dutch countryside, following the model of the workshops in Edzell, Scotland, and this helped to build personal relationships which are so important for successful scientific collaboration. Tony liked to reminisce on these days observing how the cooperation between the young scientists from Germany, the Netherlands and the UK continued long after the EEC-projects had ended and many of them had become professors. In his view the "twinning proposals" of the eighties and nineties were a very efficient way of promoting scientific cooperation in Europe and he often expressed his regret that the EU no longer supported such medium size European research projects.

Another longstanding collaboration was with Abdelhaq El Jaï from the university of Perpignan, France which culminated in the monograph [B2].

Through Abedlhaq Tony became involved in the research programme of the university of Rabat in Morocco. During the eighties he was very a influential presence in the control group by giving series of lecture courses on control to advanced students, advising doctoral students and acting as a member of the jury in doctoral examinations. Many of these students are now professors in universities in Rabat, Casablanca, Tangiers, Meknes and Marrakech.

During all this time Tony and Diederich Hinrichsen continued to work on the book, although writing was sometimes interrupted for whole years by

research questions arising from the book and other research projects. The chapters grew and grew and in the late nineties it became clear that the material had to be divided into two volumes. The first volume dedicated to systems *analysis* was finally published 2005 in the Springer "Texts in Applied Mathematics" Series. It contained most of the robustness results obtained previously. The second volume has not been completed and about 500 pages dealing with *control aspects* of systems theory (controllability, observability, model reduction, Riccati equations and H^∞ optimal control theory) remain to be published.

During all these years, Tony fulfilled his duties as a lecturer and since 1983 as professor of applied mathematics. Over the years the philosophy towards applied mathematics at Warwick had changed and the control theory centre moved to the mathematics department in 1986 with Dietmar Salamon taking up the lectureship vacated by Peter Crouch. Tony was a born lecturer. He enjoyed performing with an almost messianic zeal to rows and rows of students and continued to give a course on control theory even after retirement.

The three main loves and passions in his life were family, mathematics and sport. Over the years Tony participated in many different sports, but he excelled most in football and running. After retiring from playing football in his forties, he took up running seriously and competed in several marathons. At the age of 45 he ran the London marathon in just over 3 hours and at the age of 60 he could still run 10 km in 36 minutes. Some of his friends would say he was addicted to running. What is less well-known about Tony is that he was a bon vivant, who enjoyed cooking and serving the evening meal with a good wine to family and friends. Tony and Buddug were very hospitable and many colleagues will remember with pleasure being invited to their home during a visit to the university or after a conference or workshop. The delicious food, French wine was typically accompanied by lively discussions about politics, social questions, as well as the arts and of course, sports, especially rugby.

With the arrival of their first grandchildren Buddug en Tony spent most weekends with their daughters and their families, enjoying their role of grandparents. Tony kept up with the friends of his youth, and he loved travelling with his family and friends. It was usually he who took the initiative and organized, in the most efficient way, trips to France, Portugal, Spain, the Lake District and Wales. In 2000, to celebrate the new millenium, he set out for a 7 days walk along Offa's dyke, mostly solo, but on sections of the

route he was accompanied by various friends and family members. Tony had a real zest for life and was always optimistic. He will be dearly missed by his wife, 4 daughters, nine grandchildren and many friends and colleagues.

1.2   Books

B1 A. J. Pritchard, Stability and control of distributed parameter systems, Ph.D. thesis, University of Warwick, June, 1970.

B2 R. F. Curtain and A. J. Pritchard, *Functional analysis in modern applied mathematics.* Mathematics in Science and Engineering, Vol. 132. Acad. Press, London, 1977.

B3 A. J. Pritchard and S. P. Banks (eds.), *Proc. Second IFAC Symp. on Control of distributed parameter systems (Coventry 1977)*, Pergamon Press, Oxford, 1978.

B4 R. F. Curtain and A. J. Pritchard, *Infinite dimensional linear systems theory.* Lecture Notes in Control and Information Sciences 8. Springer-Verlag, Berlin, 1978.

B5 A. El Jaï and A. J. Pritchard, *Capteurs et actionneurs dans l'analyse des systèmes distribués.* RMA3-Masson, 1986.
Also published in English:
Sensors and controls in the analysis of distributed systems. Translated from the French by Catrin Pritchard and Rhian Pritchard. Ellis Horwood Ltd. – John Wiley & Sons, New York, 1988.

B6 D. Hinrichsen and A. J. Pritchard, *Mathematical systems theory. I. Modelling, state space analysis, stability and robustness.* Texts in Applied Mathematics 48, Springer-Verlag, Berlin, 2005.