

Conferment of the Degree of Doctor of Science, *honoris causa* A Citation



Professor Yao Chi-chih, Andrew, DEng (Hon), DSc (Hon), BS, AM, PhD

If we do our banking or pay our bills on-line we rely on the internet transactions being private, not at risk of being intercepted and read by some unintended person. Privacy is possible because such messages are encrypted, not decipherable by an unauthorized party, even using the fastest supercomputer. To an unauthorized outsider the numbers we send across the internet will appear to be random. Though most of us take this kind of technological marvel for granted, it is the product of the most sophisticated algorithms, conceived by some of the most brilliant mathematicians and computer scientists alive today. One of these is the man we are honouring here this morning, Professor Andrew Yao. In the year 2000 Professor Yao won the most prestigious award in computer science, the A.M. Turing Award, widely regarded as the Nobel Prize of computing. Among other things, the Award was given for his theory of pseudorandom number generation, which has changed the whole field of contemporary cryptography. Other achievements recognized in the Award citation included his invention of the field of “communication complexity”. Where two or more computers are working together on a task, this new approach enables the calculation of the minimum amount of interaction between the computers needed to carry out the computation. Knowing this, it is possible to work out the communication cost in the distributed task.

Professor Yao’s contributions to the field of computing science go beyond even these groundbreaking achievements, with their significant practical applications. In 2002 he gave the Sir Run Run Shaw Distinguished Visiting Scholar Lecture at the Chinese University, entitled “The Fascination of Information Science”. In this lecture he revealed that he is also making efforts to look far into the future of computing, imagining radically new possibilities, such as “quantum computers, which operate on quantum mechanical laws and can potentially solve problems currently requiring billions of years of computing time”. Such creative speculations show Professor Yao to be a man of vision, the kind of man to invent new paradigms for future exploration.

The Shaw lecture also revealed other sides of Professor Yao. Although the complexities of his mathematical thinking went well beyond the reach of most of his lay audience, Professor Yao showed a remarkable ability to communicate the essence of his work through simple examples. His analogies included wine tasting and familiar cases of random sampling. In these examples we saw Professor Yao the committed teacher, the man who believes that teaching is as essential for the professor as for the student. Teaching, he believes, “makes one realize that you don’t really understand a subject until you can explain it clearly to the students”. Here he also reveals the humility of great thinkers, ever ready to give credit to others. Describing the mathematical model of computers invented by Alan Turing in the 1930’s, Professor Yao says: “Being quite simple, the model is ideal for exploring conceptual issues in computation. Yet it can do all the computations that real modern computers can do.” Generosity towards his predecessors is characteristic of Professor Yao.



Andrew Yao was educated at Taiwan University and at Harvard, where he was awarded a PhD in Physics in 1972. Seeing the growing importance of computers at that time, he immediately did a second PhD at the University of Illinois, this time in computer science. After teaching and researching at the Massachusetts Institute of Technology (1975-1976), Stanford University (1976-1981, 1982-1986) and the University of California at Berkeley (1981-1982), he joined Princeton University in 1986 as the William and Edna Macaleer Professor of Engineering and Applied Science. In 2004, he became Professor of Computer Science at Tsinghua University in Beijing.

Professor Yao has also held research positions in the computer industry. He was a Visiting Scientist at various high technology institutes: at the IBM Research Centre in 1975 and from 1980 to 1983; at the Bell Laboratories in 1978 and at the Xerox Palo Alto Research Centre in 1979. He was a Consultant at the DEC Systems Research Centre in 1986 and at the AT&T Bell Laboratories in 1991. He was Co-Director of the NSF Discrete Mathematics and Theoretical Computer Science Centre from 1994 to 1996.

Apart from the A.M. Turing Award, given by the Association for Computing Machinery in 2000, Professor Yao has been honoured by a number of scientific bodies and institutions of higher education. In 1987 he won the George Polya Prize, awarded by the Society for Industrial and Applied Mathematics (SIAM); in 1996 the Donald E. Knuth Prize, awarded by the ACM-IEEE; and in 2003 the Pan Wen-yuan Award, given by the Pan Wen-yuan Foundation. He has been awarded honorary doctorates by the City University of Hong Kong (2003) and by the Hong Kong University of Science and Technology (2004). He was given the Alumni Award for Distinguished Service by the College of Engineering of the University of Illinois in 2004.

Professor Yao has made significant contributions to The Chinese University of Hong Kong. In 2002 he accepted the invitation of Shaw College to become its Sir Run Run Shaw Distinguished Visiting Scholar. He is also affiliated to the Institute of Mathematical Sciences. In 2005 Professor Yao formally joined The Chinese University of Hong Kong as Distinguished Professor-at-Large. His is an important presence in promoting research in computer science and mathematics at the University and in strengthening the relations between Hong Kong and the international scholarly community.

Mr Chairman, it is my privilege to present to you Professor Andrew Yao, one of the leading innovators in computer science, for the award of the degree of Doctor of Science *honoris causa*.

This citation is written by Professor David Parker