



# Biographical Sketch

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<http://www.rci.rutgers.edu/~kannan>

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## Biographical Sketch

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### Educational Qualifications

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*Ph.D. degree is from Moore School of Electrical Engineering, where Neumann introduced his famous “architecture” and fabricated the first electronic computer.*

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- **Doctor of Philosophy** in Electrical Engineering, majoring in Computer Science, University of Pennsylvania, 1964.
- **Master of Science** in Electrical Engineering, majoring in Computer Science, University of Pennsylvania, 1959.
- **Diploma of Madras Institute of Technology**, majoring in Electronics, 1957.
- **Bachelor of Science** with Mathematics as main subject, University of Madras, 1953.

### Professional Experience

- **Professor**, School of Computer Science, Jawaharlal Nehru University, 1985 - 1998
- Courses Taught
  - ◊ Theory of Computation
  - ◊ Applications of Graph Theory
- Research Areas

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*Guided Ph.D. students in some of the following topics on the foundations of computer technology.*

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- ◊ Standardization of definitions and symbols in mathematical sciences. This became particularly important after the availability of typesetting programs like T<sub>E</sub>X. Graph Theory was one of the subjects taken up.
- ◊ A uniform treatment of matrices with elements from regular expressions to real numbers is helpful in teaching the theory of computation. How the deeper concepts of eigenvalues and eigenvectors evolve when elements of the matrices become more and more structured was investigated.
- ◊ A new machine called NuMachine has been used in JNU as a model of computation. The machine can be defined as a specialized graph and a NuAlgebra goes along with the machine.

- ◊ If mathematical logic is to be useful to computer science students, it should read like regular mathematics. The paper on Gödel's Theorems listed in the publications given later attempts to achieve this with suggestive symbols and terse comments. A significant result obtained was the classification of all the statements of Elementary Arithmetic into four classes.
- ◊ Many concepts in mathematics and computer science can be rewritten much more simply if appropriate notations are developed. See the papers on Shannon's Entropy and Arrow's Dictator Theorem listed later, for illustrations. These papers show that verbosity in computer science texts can be avoided.
- ◊ The use of lattice theory and information theory in the analysis of databases.
- ◊ Computer-assisted education, multimedia technology, and networks.

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*The following five items are concerned with the Internet and need serious attention.*

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- ◊ Use of XML in business-to-business communications to monitor production progress and delivery of products. XML will be a dominating factor of e-commerce and mobile computing in the future.
- ◊ Refining of data produced in the Internet and data mining.
- ◊ Conversion between HTML, XML, SGML, PDF, and TeX formats.
- ◊ Efficient algorithms to search terabyte databases in the Internet using metadata.
- ◊ Instruction through virtual universities including higher education.
- University Services

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*As Dean of the School of Computer Science, apart from administering the research in the University, helped the other national institutions also in their research.*

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- ◊ Dean, School of Computer Science, 1985-87
- ◊ Installed a large VAX computer system in the University
- ◊ Introduced M.Tech program in the School
- ◊ Increased the intake of students in the School many fold
- ◊ Assisted neighboring IIT to introduce M.S. program
- ◊ Served in selection committees of IITs, ISRO, UPSC, and other national institutions
- ◊ Assisted the Union Government to set up the Biotechnology Information Network in the country
- ◊ Served in the JNU implementation committee of New Education Policy of Union Government
- ◊ Served in the Academic Council, Executive Council, and Court of the University
- **Visiting Professor**, University of Illinois at Chicago, 1984-85
- Taught Data Structures and Network Analysis
- **Visiting Professor**, Indian Institute of Science, 1981-84, 1971-74
- Introduced a course on VLSI systems

- Consulting work for the industry
- **Head, R & D (Computers)**, Bharat Electronics Ltd., 1974-81

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*The team of outstanding young researchers who worked with me in R & D are now spread around the world in prestigious research laboratories.*

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- Designed and developed computer peripherals, general purpose processors, computer systems, electronic exchanges, numerical controls, and several digital equipment for Post and Telegraph departments
- A ruggedized minicomputer was designed, developed, and manufactured for the army. These were the days when the bitslice processors Intel 4004 and 8008 were in the market
- **Associate Professor**, Drexel University, 1964-71
- Taught several graduate and undergraduate courses
- Sponsored research included Electromagnetic Scattering and Lyapunov functions
- **Research Specialist**, Philco Research Laboratory, Blue Bell, 1962-64
- Worked on pattern recognition
- **Instructor**, University of Pennsylvania, 1958-62
- Taught several graduate and undergraduate courses
- Sponsored research included real time flight data analysis applicable to missile systems

## Publications

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*All the publications below are the result of my attempt to simplify the concepts of computer science to my students.*

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- *Answer to Foster's Open Question*  
IRE Transactions on Circuit Theory, Vol. CT-10, pp. 126-127, March 1963
- *On n-Port Networks: A Matrix Theorem and an Open Problem*  
IEEE Transactions on Circuit Theory, Vol CT-10, p. 454, September 1963
- *A Generalization of the Equicofactor Matrix*  
IEEE Transactions on Circuit Theory, Vol CT-11, pp. 289-290, June 1964
- *On the Realization of Singular R-Matrices*  
IEEE Transactions on Circuit Theory, Vol CT-11, pp. 421-423, September 1964
- *On the Application of Discriminant Analysis to Identification of Aerial Photography*  
Proceedings of the 7<sup>th</sup> National Military Electronics Convention, Washington D.C. 1964 (with L. Kanal)
- *A Topological Test for the Realizability of a Class of Resistive n-Ports*  
IEEE International Convention Record, Part I, pp. 263-269, March 1964 (with L. Kanal)
- *A Note on the Walsh Function*  
IEEE Transactions on the Electronic Computers, Vol EC-13, pp. 631-632, October 1964
- *A Generalization of Maximum Power Transfer Theorem*  
Proceedings of the IEEE, Vol. 57, pp. 1339-1340, July 1969

- *A Note on Superposition Principle*  
Proceedings of the IEEE, Vol. 57, No. 8, pp. 1426-1427, August 1969
- *A Note on the Energy Function*  
IEEE Transactions on Education, Vol. 13, pp. 62, July 1970
- *An Application of Compound Matrices to Linear Systems*  
IEEE Transactions on Circuit Theory, Vol. CT-17, pp. 626-628, November 1970
- *Solution to Harrison's Problem*  
IEEE Transactions on the Electronic Computers, Vol. C-19, pp. 160-167, February 1970
- *Approximation and Representation of Joint Distribution of Binary Random Variables by Walsh Functions*  
Proceedings of Applications of Walsh Functions, Naval Research Laboratory, Washington D.C., 1970
- *Some Fundamental Concepts of Relational Databases*  
Journal of the Computer Society of India, Vol. 8, No. 2, pp. 41-48, June 1978
- *Some Analytical Tools for the Design of Relational Database Systems*  
Proceedings of the Sixth International Conference on Very Large Databases, Montreal, Canada, pp. 417-428, October 1980
- *Representation of Functional Dependencies in Relational Databases using Linear Graphs*  
Theoretical Computer Science, Vol. 24, pp. 143-159, Spring 1983 (with V. G. Tikekar and T. Radhakrishnan)
- *A Generalization of Functional Dependencies in Relational Databases and Use of Boolean Algebra*  
Journal of the Indian Institute of Science, Vol. 64(B), pp. 219-228, August 1983 (with V. G. Tikekar)
- *Arrow's Paradox and the Percentage Voting Systems*  
Current Science Vol. 56, No. 21, pp. 1085-1089, 1987
- *Fractional Voting System*  
Current Science Vol. 56, No. 19, pp. 1076-1081, 1989
- *An Axiomatic Definition of Shannon's Entropy*  
Applied Mathematics Letters, Vol. 5, No. 4, pp. 45-46, 1992 (with P. Varma and V. Saroch)
- *A Graph-Theoretic Proof of Arrow's Dictator Theorem*  
Applied Mathematics Letters, Vol. 5, No. 6, pp. 61-62, 1992 (with V. Saroch and P. Varma)
- *A Note on Inductive Probability*  
Applied Mathematics Letters, Vol. 7, No. 4, pp. 41-43, 1994
- *Ackermann Functions and Transfinite Ordinals*  
Applied Mathematics Letters, Vol. 8, No. 6, pp. 51-53, 1995
- *Sentient Arithmetic and Gödel's Theorem*  
Computers and Mathematics, Vol. 32, No. 2, pp. 69-73, 1996
- *NuMachine and NuAlgebra*  
Computers and Mathematics, Vol. 32, No. 4, pp. 105-107, 1996
- *Matrices with Elements from a Division Ring*  
Mathematical and Computer Modelling, Vol. 24, No. 1, pp. 1-3, 1996
- *A Graphic Illustration of Rogers-Ramanujan Identities*  
Applied Mathematics Letters, Vol. 9, No. 5, pp. 11-15, 1996

- *Structured Labels and Directed Paths*  
Mathematical and Computer Modelling, Vol. 24, No. 10, pp. 1-2, 1996
- *Matchings and Pfaffians*  
Mathematical and Computer Modelling, Vol. 25, No. 2, pp. 1-2, 1997
- *Hall's Theorem and Compound Matrices*  
Mathematical and Computer Modelling, Vol. 25, No. 3, pp. 23-24, 1997
- *Boyce-Codd Normal Form Decomposition*  
Computers and Mathematics, Vol. 33, No. 4, pp. 1-3, 1997 (with B. Gopinath, T. Nagaraj, and S. Manjunath)
- *Justification of the Continuum Hypothesis*  
Computers and Mathematics, Vol. 33, No. 5, pp. 1-3, 1997
- *Axiomatic Derivation of the Continuum Hypothesis*  
Computers and Mathematics, Vol. 38, No. 3-4, pp. 225-227, 1999
- *Real Set Theory*  
Computers and Mathematics, Vol. 38, No. 7-8, pp. 167-171, 1999
- *Intuitive Set Theory*  
Computers and Mathematics, Vol. 39, No. 1-2, pp. 183-185, 1999
- *Web Publishing using Hyper $\text{\LaTeX}$*   
A Web Publication
- *Intuitive Set Theory: A Tutorial*  
A Web Publication
- *Generic Dependencies and Database Design*  
Computers and Mathematics, Vol. 41, No. 3-4, pp. 281-288, 2001
- *Visualization of Intuitive Set Theory*  
Computers and Mathematics, Vol. 41, No. 5-6, pp. 619-626, 2001
- *Compound Matrices and Three Celebrated Theorems*  
Mathematical and Computer Modelling, Vol. 34, No. 3-4, pp. 251-255, 2001 (with Shanti Sreevalsan)
- *Shannon's Communication Channels and Word Spaces*  
Mathematical and Computer Modelling, Vol. 34, No. 7-8, pp. 757-759, 2001
- *Theory of Search Engines*  
Computers and Mathematics, Vol. 42, No. 12, pp. 1523-1526, 2001
- *White Hole, Black Whole, and The Book*  
Computers and Mathematics, (to be published)

### Theses

- *Lossless Multiconductor Transmission Lines*  
M.S. Thesis, University of Pennsylvania, 1959
- *Representation of Distributions of Binary Random Variables*  
Ph.D. Thesis, University of Pennsylvania, 1964

### Invited Lectures

- Dr. Narsinga Rao Memorial Lecture

- Broadcasts by All India Radio
- Lectures to Mathematical Olympiad Winners
- Lecture during Ramamujan Centenary Celebrations
- Lectures at national research institutions

### **Memberships and Honors**

- Tau Beta Pi
- Eta Kappa Nu
- Sigma Xi
- Institute of Electrical and Electronic Engineers
- Association for Computing Machinery
- American Association for Advancement of Science
- New York Academy of Sciences
- Computer Society of India
- Indian Science Congress Association
- American Mathematical Society
- IEEE Computer Society

### **Editorial Board**

- International Journal of Management and Systems
- Journal of Systems Science and Engineering

### **Consulting Activities**

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*Both the factories below are concerned with information technology.*

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- Indian Telephone Industries, Bangalore
- Bharat Electronics Limited, Bangalore
- Saunders Publishing Company, Philadelphia

### **Professional Listing**

- American Men of Science
- Encyclopedia of Indian Scientists
- Who'sWho in the World (15th Edition)
- Mathematical Sciences: Who's Who (1998)

### **Mission**

- To be part of an international center for higher education and research

- To promote the use of sophisticated markup languages in the Internet, including T<sub>E</sub>X

**Personal Data**

- *Wife*: Vimala
- *Children*: Prita, Shanti, Pravin, Sarita
- *Hobbies*: Tennis, Golf, Flying

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