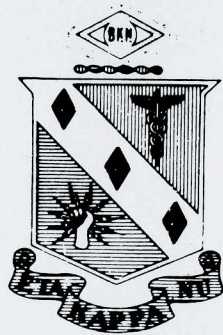


BRIDGE

A black and white portrait of Dr. Vladimir Karapetoff, an older man with short, light-colored hair, wearing glasses, a dark suit jacket, a white shirt, and a patterned tie. He is shown in profile, looking towards the left. The background is dark and out of focus.

Dr. Vladimir Karapetoff

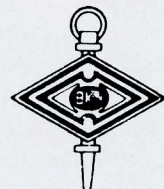


Editor and Business Manager
J. Robert Betten

NOVEMBER 1988
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Laureen Parker
Didier Schott
Berthold Sheffield
Michael Wisland



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**** NOTICE ****

HKN Board
Proposes Amendment
to the HKN Constitution,
See page 11.

SPENCER GREENE

WINS

NORMAN R. CARSON AWARD

AS

OUTSTANDING EE JUNIOR

by Laureen Parker, Past Member, HKN Board

For 1986-1987, Spencer Greene from Rice University's Theta Rho Chapter has been selected as the winner of the Norman R. Carson Outstanding Junior in Electrical Engineering Award.

Each year Eta Kappa Nu honors a junior in electrical engineering for his or her scholastic and technical achievements and leadership abilities. It is the objective of this award to recognize a student's ability to lead, persuade and to influence the actions of others as well as to recognize his or her diligence, intelligence and technical competence.

Spencer has maintained a straight A average while

pursuing a double major in electrical engineering and French at Rice University. The recipient of many scholarships and awards in math and languages as well as in engineering, he has also been active in several organizations around campus.

He is a member of the French club, Club des Hiboux, and has served as the president of the French honor society, Pi Delta Phi. He has been a reporter for the student newspaper and has held the offices of news editor and back page editor. In the spring of 1987, he served as the editor-in-chief. This year, Spencer is the engineering director of the student radio station, KTRU-FM. He has served as the chapter secretary for ACM/IEEE CS and as the chapter cataloger for Tau Beta Pi. His employment history includes work at engineering firms for the last three summers. Since 1983, he has been self-employed as a microcomputer programmer for several companies in and around Houston.

The award was presented to Spencer by Laureen Parker, International Director, at the Fall Smoker given by the University of Texas' Psi Chapter. The party was attended by 80-90 people from the Psi Chapter, the Texas Alumni Chapter, the University of Texas faculty, and guests.

The runner-up this year goes to Manish Arya, Mu Chapter, University of California at Berkeley. Honorable Mentions are: Nelson C. Chu, Beta Lambda Chapter, Virginia Polytechnical Institute; Jonsie K. Ivey, Zeta Epsilon Chapter, Florida Institute of Technology; Donald C. Ramsey, Jr., Epsilon Lambda Chapter, Vanderbilt University; Jacqueline M. Solomon, Beta Delta Chapter, University of Pittsburgh; and George J. Woyansky, Epsilon Eta Chapter, Rose-Hulman Institute of Technology.

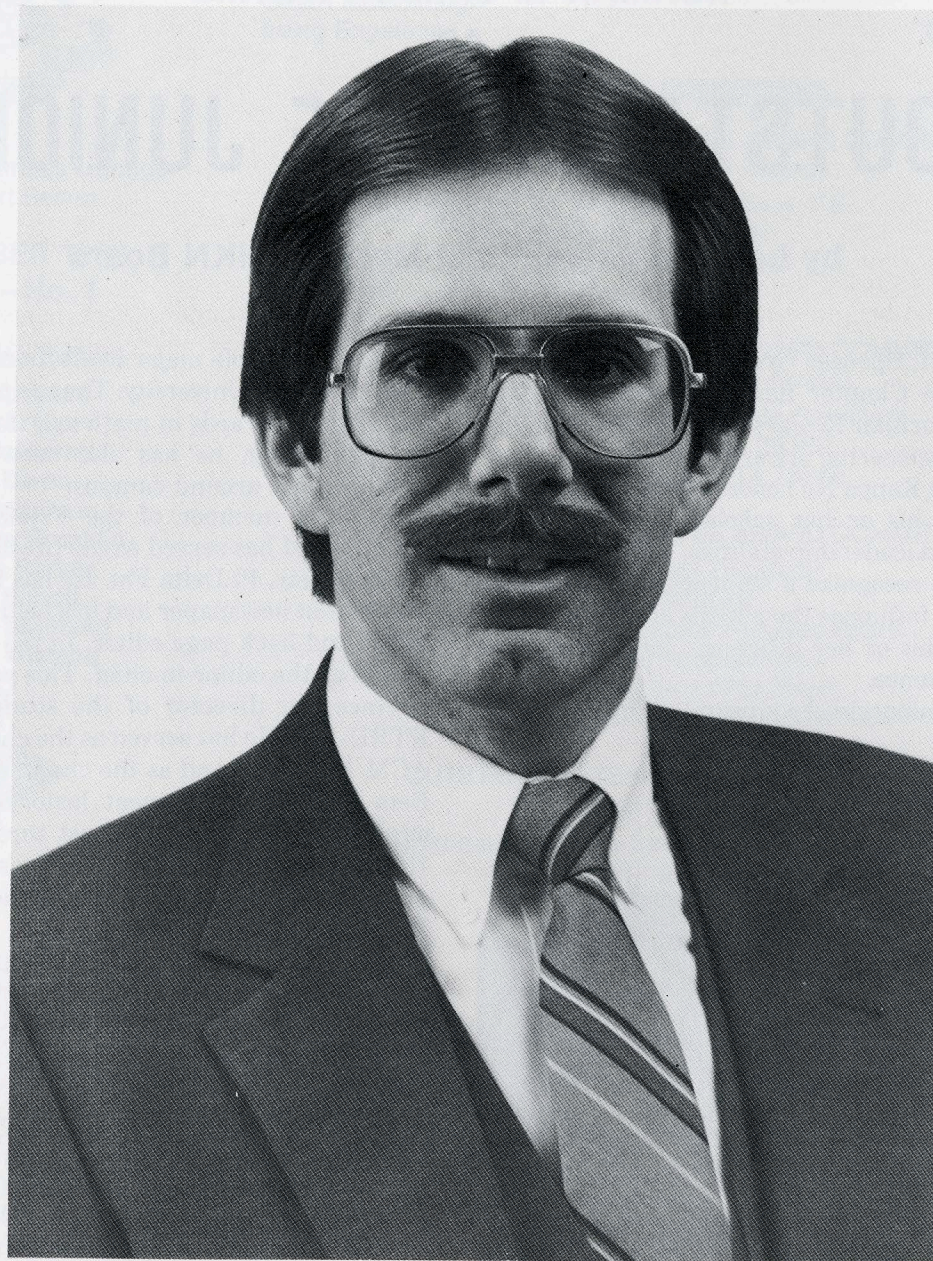
The students have excelled in their academic and technical achievements, participated in college community activities, and shown initiative and leadership. Congratulations to each of the winners for his or her outstanding academic and personal achievements.



Spencer Greene receives Award Certificate from Laureen Parker

OUTSTANDING YOUNG EE AWARD

by Dr. Irving Engelson, Chairman, OYEE Award Committee



James G. Frohlich

The Eta Kappa Nu Outstanding Young Electrical Engineer Award is given annually to young electrical engineering graduates for meritorious service in the interest of their fellow men and women as well as for outstanding achievements in their chosen profession. The winner and honorable mention(s) of this prestigious award are selected each year through a well-defined process which has remained virtually unchanged since

its inception. The nominations process involves the initiative of the nominator and the participation of a number of references in support of the candidate. The dossiers of all nominees are carefully screened by the Award Organization Committee which selects up to 10 finalists. These finalists are judged by a jury of highly prestigious leaders of the profession for final selection of the winner and honorable mention(s).

It is particularly gratifying when the winner of the award is recognized for achievement in an area of significant national importance. Over the past several years, concern has been expressed about deteriorating quality and productivity in the U.S. manufacturing sector. The quality of U.S. goods, which used to be regarded as a standard of excellence, has been surpassed by other countries. Increasing costs of manufacturing, and strong competition in automation, have caused the loss of manufacturing jobs in the United States and a diminution of the U.S. manufacturing enterprise. Fortunately, we are beginning to see a rejuvenation of excellence in manufacturing technology in the U.S. The 1987 award winner is being honored for his achievements in manufacturing technology. The fact that this important industrial field is beginning to attract the brightest among young engineers gives us hope for the future.

James G. Frohlich is the Outstanding Young Electrical Engineer of 1987. His award was presented at the 52nd Anniversary Eta Kappa Nu Banquet in Philadelphia on April 25, 1988. At the same ceremony, Nader Mehravari and Stefan A. Siegel were each awarded Honorable Mention for 1987.

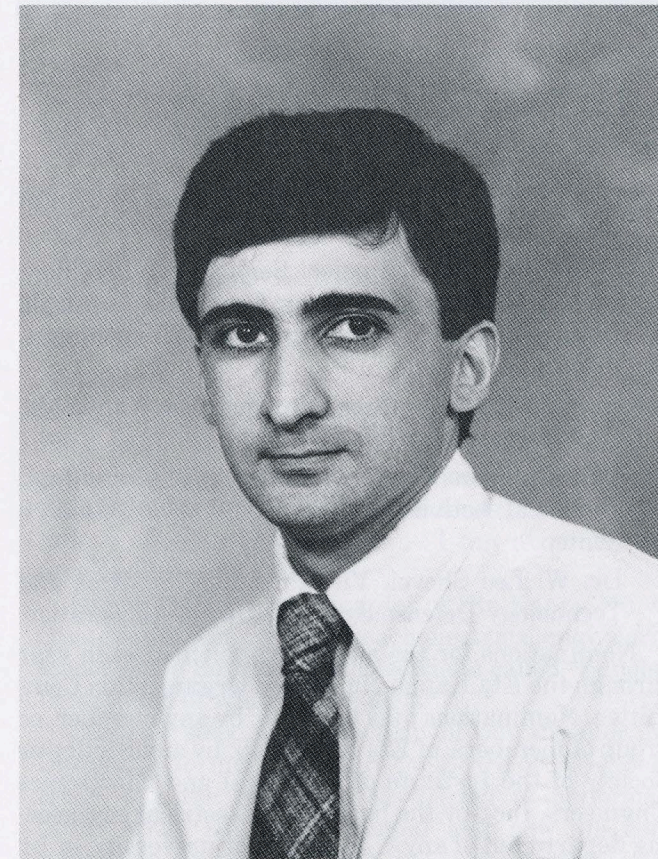
Mr. Frohlich is an account development representative at IBM Corporation, Seattle, Washington. At the time of his selection as Outstanding Young Electrical

Engineer, he was a staff engineer at IBM in Tucson, Arizona. He was named Outstanding Young Electrical Engineer for his "achievements in manufacturing technologies, his accomplishments in music, and his contributions to meeting human needs."

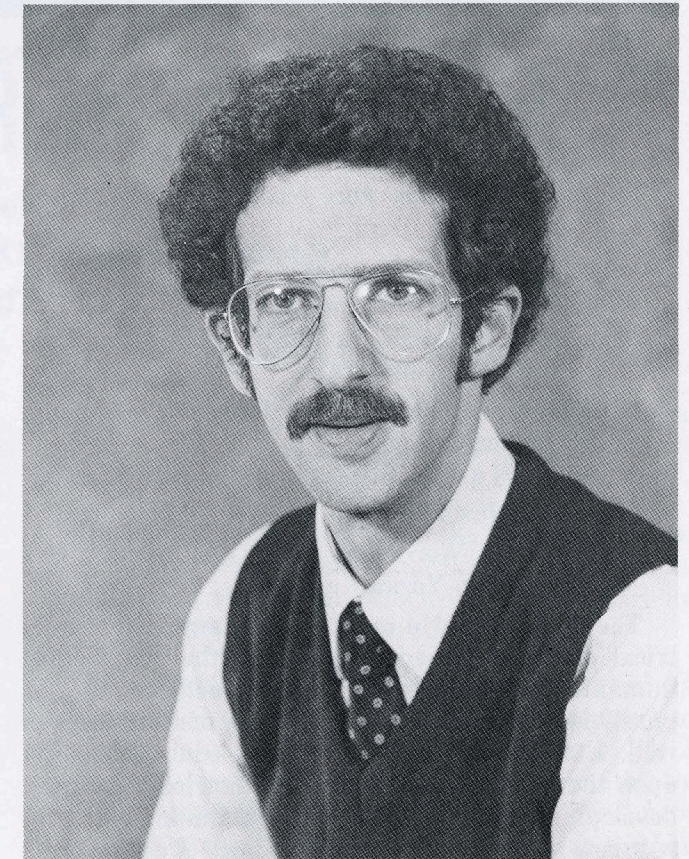
Mr. Mehravari is a member of the Technical Staff at AT&T Bell Laboratories in Holmdel, New Jersey. He received his honorable mention for his "contributions to the field of communications and his participation in church activities and professional societies."

Mr. Siegel is a member of the Technical Staff at the David Sarnoff Research Center in Princeton, New Jersey. He received his honorable mention for his "achievements in electro-optics, his involvement in the arts, and his contributions to human welfare."

The award winners were honored for their contributions to electrical engineering and for their contributions to society at large. Mr. Frohlich was nominated by Mr. Grant M. Bright, Development Engineer, IBM Corporation, Tucson, Arizona. Mr. Mehravari was nominated by Dr. M. Iwama, Executive Director, Switching Systems Engineering Division, AT&T Bell Laboratories, Holmdel, New Jersey. Mr. Siegel was nominated by Dr. Robert A. Bartolini, Head, Optoelectronic Systems Research, David Sarnoff Research Center, Princeton, New Jersey.



**Nader Mehravari
HONORABLE MENTION**



**Stefan Allen Siegel
HONORABLE MENTION**



The Jury of Award: 1987 Outstanding Young Electrical Engineer Selection

Five other engineers were recognized as first-time finalists:

Mary C. Bertrand, General Electric Company, Daytona Beach, Florida

Charles B. Dieterich, David Sarnoff Research Center, Princeton, New Jersey

Kenneth B. Donovan, General Electric Company, Daytona Beach, Florida

Patrick R. Trischitta, AT&T Bell Laboratories, Holmdel, New Jersey

Matthew R. Wordeman, IBM/T. J. Watson Research Center, Yorktown Heights, New York

The Eta Kappa Nu recognition is awarded to electrical engineers to emphasize that their service to humanity is manifested not only by achievements in purely technical areas but in a variety of other ways as well. Eta Kappa Nu holds that an education based upon the acquisition of technical knowledge and the development of analytical and logical thinking is a prerequisite to achievement in many lines of endeavor.

The Jury of Award usually consists of prominent educators, industrialists, or professional leaders. In 1987, the jurors were:

Dr. Robert F. Elfant, General Manager, Intel Corporation

Dr. George H. Heilmeier, Senior Vice-President and Chief Technical Officer, Corporate Research, Development and Engineering, Texas Instruments, Inc.

Dr. Harold K. Knudsen, President, Eta Kappa Nu, University of New Mexico

Dr. Emerson W. Pugh, IEEE Vice-President, Technical Activities, IBM/T. J. Watson Research Center

Dr. W. Lee Shevel, Vice-President, Systems and Technology Defense Systems, Unisys Corporation

Nominations for the award are solicited each year through the Eta Kappa Nu Award Organization Committee. Nominations may be made: by any member, or group of members, of Eta Kappa Nu; by any Section or Society of the Institute of Electrical and Electronics Engineers, Inc.; by the head of the electrical engineering department of any U.S. college or university; or by other individuals or groups, who in the opinion of the Award Organization Committee, are properly qualified to make nominations.

The nominations for the awards should be submitted each year to the Chairman of the Award Organization Committee, or to the Executive Secretary of Eta Kappa Nu, by August 1. An eligible candidate is one who:

- has an electrical engineering degree (B.S., M.S., or Ph.D.) from a recognized U.S. engineering school;
- will have been graduated not more than 10 years as of May 1 of the award year from a specified baccalaureate program; and
- will not yet have reached his or her 35th birthday as of May 1 of the award year.

Awards are based upon: (1) the candidate's achievement of note in his or her chosen work, including inventions of devices or circuits, improvements in analyses, discovery of important facts or relationships, development of new methods, exceptional results in teaching, outstanding industrial management, or direction of research and development; (2) the candidate's service to community, state, or nation, such as activity in philanthropic, religious, charitable, or social enterprises, leadership in youth organizations, or engagement in civic or political affairs; (3) the candidate's

cultural and aesthetic development, such as work done in the fine arts, architecture or the dramatic arts. Studies in history, economics, or politics are also highly valued as well as any other noteworthy accomplishments including participation in professional societies and other organizations.

The Award Organization Committee members are: Irving Engelson, Staff Director, Technical Activities, The Institute of Electrical and Electronics Engineers, Inc. (Chairman); Ralph J. Preiss, IBM Corporation (Vice Chairman/Secretary); Clarence A. Baldwin, Westinghouse Electric Corporation; Donald Christensen, IEEE Spectrum; James A. D'Arcy, RCA Laboratories; Larry Dwon, Consultant (formerly of American Electric Power Service Corporation); Anthony F. Gabrielle, Gulf State Utilities; Quayne G. Gennaro, Bell Atlantic; Willard B. Groth, IBM Corporation; Albert J. F. Keri, American Electric Power Service Corporation; Robert W. Lucky, AT&T Bell Laboratories; Stephen A. Mallard, Public Service Electric and Gas Company; George A. Mangiero, Brooklyn Polytechnic Institute; William E. Murray, Douglas Aircraft Company; Berthold Sheffield, RCA Corporation (retired); Joseph J. Strano, New Jersey Institute of Technology; and Lawrence D. Wechsler, General Electric Company.

MY SUMMER IN AMERICA

by **Didier Schott**

**First President, HKN College Chapter
Ecole Supérieure d'Electricité—France**

Monday, June 20th: I arrive in New York from Paris with 20 hours late, it is hot and humid—my American trip begins . . . Two hours later, I am in Philadelphia, the City of Independence . . . the Liberty Bell . . . Benjamin Franklin . . . I am about to work here for 2 months.

One year ago, a new chapter of Eta Kappa Nu was created overseas, in my French electrical engineering school Ecole Supérieure d'Electricité called "Supelec": 13 students of whom 3 are girls.

Step by step, with the help of our director Mr. Delcroix, a former director of the Board of Directors of HKN. All the members have tried to understand better what HKN represented and how we could contribute. (In fact, you can't find such an organization in France.) The best means was to come and see in America . . .

. . . Mr. Arehart, a former director of HKN offered me a great opportunity to come to America, live with him and his wife and to work in his Enterprise.

During 2 months, I worked in the Transmission and Distribution Branch and Relay Branch in the Philadelphia Electric Company which distributes electricity power in Philadelphia and its suburbs.

Such work, especially in America, is not only a summer job, but also a means to discover a country, to share and to understand better another way of life. I have been learning many things for 2 months by speaking, reading, watching TV,—seeing the 4th of July, the presidential campaign and many other things . . .

Continued ►

Since my arrival, I have particularly been meeting many members of HKN. This will be very helpful for our chapter.

Now I have been working here for almost two months and I am about to take some vacation: 6 weeks vacation with my girl friend who is going to join me for a long trip throughout the U.S.A.: Niagara Falls, Denver, Grand Canyon, New Orleans, New York . . .

Didier Schott

by Robert F. Arehart, Past Member, HKN Board



Didier Schott and Robert Arehart, Summer, 1988

the America is so great and has so much to give.

I enjoyed, and I keep on enjoying myself, and I wish you to go overseas to Europe (and in France especially!) which is quite different—it is worth seeing it.

America, it was a dream which became reality—a great experience, . . . a great pleasure—

—hope to come again

Didier Schott

Didier is a student in the most elite school of engineering in Paris, by name, Ecole Supérieure d'Electricité (the most important French "Grande Ecole" of electrical engineering and computer science). He has one more year of schooling to complete when he returns to Paris.

Through the guidance of one of his instructors, Jean-Loup Delcroix (a former director of Eta Kappa Nu), an HKN chapter was formed and Didier was elected the first President. In February 1988, after having seen the article on newly elected directors in the February 1987 issue of the *Bridge*, Didier wrote to me inquiring as to the possibility of his coming to America for the summer. He stated a need for housing and the certainty of a job for approximately eight to ten weeks. I was able to secure him temporary employment in the engineering division of the Philadelphia Electric Company and Helen and I were able to have him as a guest for the summer.

He arrived June 20, 1988 flying into New York late at night on a plane that had been delayed 20 hours. In the morning he came by train into 30th Street Station, called me at the office, and I walked over to the station and brought him back to the company where he spent the remainder of the day, traveling home with me by train in the evening.

It has been an interesting eight weeks for all of us. We tried to cover as much local scenery as possible: Old Philadelphia; Penn's Landing; outdoor Pennypack Park concert; Kutztown Fair; Lancaster area; Washington, D.C., where we walked and walked, viewing White House, Capitol, and the Washington, Lincoln, Jefferson and Viet Nam memorials.

In his time with us we learned much about France, concerning government, attitudes, customs and food choices. He was amazed by much of our lifestyle as well as the lack of our government's financial involvement in every day, individual matters—such as education and poverty. Helen has tried to "sum up" some of our interaction in the rhyme to follow.

Didier Schott

"In America"

June 20–September 27, 1988

From France he came,—from Paris
To see the U.S.A.
Young, tall, blue eyed and handsome
Quite French,—in every way.

And skilled upon the water—
A sailing teacher, he.
Karate too,—black belt in that
Yet, gentle as could be.

His mind, so quick and probing—
Excelling memory!
An engineer of detail
In electricity.

The food he found in this land
Was really rather good—
Ate our many casseroles—
And "never knocked on wood."

Perplexed by all our phrases.
Like "raining cats and dogs"
"American as apple pie"
He started keeping logs.

He snapped his rolls of pictures
A high-class camera
Guarded with his very life
For memorabilia.

In languages, he's expert
But English was his quest
He questioned each new word sound
Though French was always "best."

His land of France requires that
The young master our tongue.
Thus he,—quite versed in English,
At three he had begun.

He also spoke in other tongues
And read maps intensely
Viewed our Presidential race—
"The show was fun to see!"

"Americans are proud folk—
The flag flies everywhere.
But youth are left untutored"
He viewed that with despair.

Americans think English
The language of the world.
And plant it deep in foreign soil
As though the flag unfurled.

Some things he found distasteful
Our slums and poverty,—
And grown adults not reading—
Confusing mystery.

The size of our great country
Was hard to comprehend.
That France could fit in Texas
Seemed land without an end.

Numbers were a game to him
We're in an infant stage.
We still think metric foreign
Our rules still so stone-age.

Our ways and customs so strange
"Incredible," he'd say.
"Americans put money—
In front of fun and play."

Luxuries of life he felt
Americans want most.
Or happiness escapes them
Their joy seems of their boast.

"The French," he'd state, "enjoy life—
They're blessed with Holiday—
Creative, educated
Fun first makes work OK."

With strong determination
He spoke of France with pride
Defended all its history
And argued on its side.

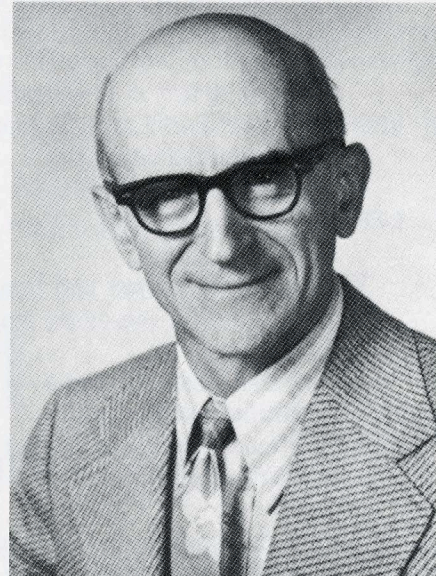
America!—the dream land
A place to go and see
Our way of life,—our people
A kind of fantasy.

Our land appears more real now,—
Through heat, and cold, and rain,
Wave our flag with honor!
He'd like to come again.

Helen W. Arehart

Computer Languages— A Guide for the Perplexed

A Book Review
by
Bert Sheffield
HKN Publicity Chairman



Computer Languages—A Guide for the Perplexed by Naomi S. Baron, Anchor Books, Anchor Press/Doubleday, Garden City, N.Y., 1986, 419 pages; \$17.95.

This fascinating book is a superb reference and introduction to computer languages written for a gamut of computer users from tremulous beginners to experienced programmers. The author, evidently well versed in both computer science and linguistics, uncovers the mysteries behind 22 computer languages in detail, and discusses 17 additional ones briefly in an appendix. Thus, its subtitle notwithstanding, it differs vastly from Maimonides' *A Guide for the Perplexed* whose content was reportedly not disclosed to people without philosophical training.

Dr. Naomi S. Baron, a former Guggenheim Fellow, is a graduate of Brandeis and holds a doctorate from Stanford. She is presently Associate Dean for Undergraduate Affairs, and Professor of Language and Foreign Studies, at American University in Washington, D.C.

The book fascinated me because author Baron answers a multitude of often poorly answered questions as: "why learn about computer languages?" (She proposes convincingly): "To participate in contemporary culture . . . To prepare for the future.") And once one is convinced of the need, "which language should one study, and should one study more than one?" and, "how difficult is it to master, say, BASIC, or Pascal, compared with learning a foreign language?" "What if I spend years learning a computer language that goes the way of 78 rpm records?" These and other questions are answered clearly and thoughtfully.

A number of languages are ranked on the time it takes to learn them "passably well." On a scale of one to ten, (10 being the most time-consuming), PILOT is rated 1, BASIC 3, Pascal 4, LISP 6, and ADA 10. C is rated seven, and "generally isn't a good beginning lan-

guage. While it can be learned from scratch, C's virtues are largely lost on people without prior background in computing."

While the book treats principally languages developed in the United States, some languages developed in Europe are included. In view of the author's expertise "more attention is paid to the use of computer languages on microcomputers than on larger systems."

The author is an inspiring teacher. Her book is full of metaphors because ". . . it is easier to learn a strange concept through analogy than to approach it head-on." For example, "An operating system is like a traffic cop." And again, "The structure of Pascal is like the structure of a small town."

Regarding the phrase "computer language" she explains that it "began as a convenient metaphoric hook upon which to hang instructions for manipulating the insides of a machine."

The book explains computer terms, of which some are absolutely necessary and others simplify programming. Terms are discussed in refreshingly understandable detail, such as: operating systems, editors, subroutines, macros, tool kits, assemblers, linkers, debuggers and others. Regarding assemblers she says, they "are not nearly as difficult to learn as some critics make them out to be." Interpreters and compilers are introduced, and their applications and relative advantages are compared in clear terms.

The strong degree of similarity between two languages is shown by illustrating the solution of the same problem in two languages, for example in both LOGO and in LISP. Another problem is solved in both BASIC and APL, to illustrate "just how compact an APL program can be."

Historical highlights are presented in thought-provoking detail. For example, a Mariner spacecraft was

ordered destroyed in 1962, 290 seconds after launch, apparently due to a computer malfunction. According to the book "presumably" this error might not have arisen if the computer had been programmed in a "strongly typed (and strongly type-checked)" language, such as ADA.

The book is divided into three parts plus an appendix.

Part I (the first three chapters) titled "THE LANGUAGE METAPHOR" is a brief course on programming languages.

Part II "SURVEY OF COMPUTER LANGUAGES" includes in chapter 4, "Choosing Among Languages and Learning and Buying One." In chapter 5, which comprises about 70 percent of the book, 22 languages are described in detail. They are presented alphabetically, each in an identical arrangement which allows easy reference and comparisons. The main sub-

titles are: Profile (including genealogy of the language X); Why Language X; Thinking in Language X; The Evolution of X; The Future of X; Using X; and finally, under the caption "What to Read," many references to relatively recent literature and sometimes also other helpful sources.

Part III, titled "CODA," includes "Divining the Future" (chapter 6) and an APPENDIX of 11 pages with brief descriptions of 17 other languages.

The dedication to "Ma-Baba Across the World" perplexed me. The author informed me it refers to her in-laws who, in India (Across the World), are jointly addressed in the traditional fashion as "Ma-Baba."

A few words are missing from the last paragraph on The Future of Smalltalk, (page 370). The omission does not detract from the excellence of this enlightening book, which is truly "A Guide for the Perplexed."

****NOTICE****

CONSTITUTIONAL AMENDMENT Proposed by HKN Board of Directors "Broadening Eta Kappa Nu Membership Requirements"

Eta Kappa Nu is an electrical engineering society. The field of electrical engineering has grown tremendously since Eta Kappa Nu's founding in 1904, and indeed since its constitution was last amended in 1958. Our constitution states that in order to be eligible for membership, an undergraduate student must be in an accredited degree program in electrical engineering. The Board of Directors is responsible for the interpretation of the constitution. Boards have, during the past several years, been studying the definition of electrical engineering, and in particular have addressed the question: are computer engineers who are in programs leading to baccalaureates in computer engineering eligible for membership in Eta Kappa Nu? The issue is an important one because some computer engineering students receive EE degrees while others receive CompE degrees. We do not wish to exclude from Eta Kappa Nu students who have similar backgrounds and interests.

As a result of these studies, the board has reached a clear consensus that Eta Kappa Nu should regard computer engineering students who are actually pursuing an engineering curriculum with substantial electrical content on the same basis as other students who are pursuing other branches of electrical engineering.

Chapters are therefore permitted and encouraged to accept computer engineering students whose course of study is in accordance with the foregoing philosophy, and who meet all other established criteria for membership in Eta Kappa Nu. Computer engineering curricula that are accredited by ABET may be considered as generally containing the desired electrical engineering content.

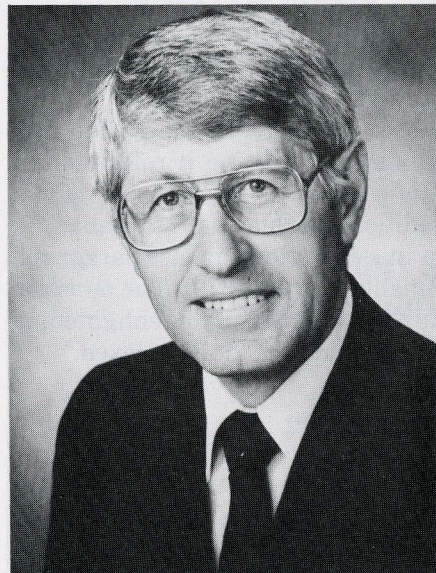
Furthermore, to make evident the increased scope of electrical engineering, the Board of Directors recommends that the Eta Kappa Nu Constitution be amended as follows:

Add to Article II a new section 6:

Section 6. For the purposes of this Constitution, Electrical Engineering shall be interpreted to include those overlapping branches of Engineering that are based substantially on the application of electrical science, which branches are deemed to include, but not be limited to, Computer Engineering.

Amendments to the constitution require ratification by the chapters. Ballots for the ratification of the amendment will be distributed at the next Mail Convention which will be held later this year.

NEW OFFICERS AND DIRECTORS



Virgil Ellerbruch
President

Virgil George Ellerbruch was born in Bloomfield, Nebraska and at the age of five years the family moved to Wyoming. All schooling was in Wyoming. Higher education began with the two-year college in Casper and ended with the Ph.D. at the University of Wyoming.

Kinnear, Dubois, Lander, Casper, Cheyenne and Laramie have all been residence cities in Wyoming. A small school at Kinnear was attended for ten years and then a move made to Lander. The high school graduating class at Lander had 34, so like many South Dakota students the schools attended were rather small.

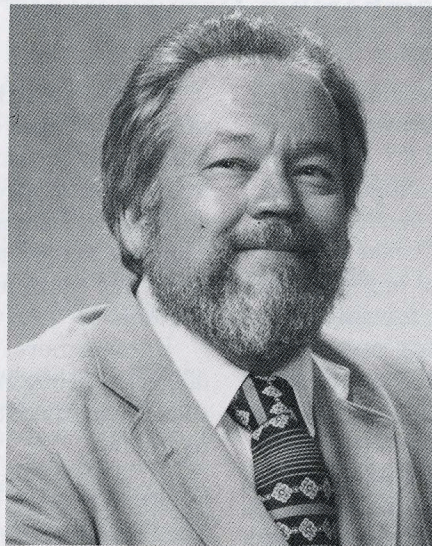
Five years were spent as an automotive engine rebuilder before and while attending college. Industrial experience with missile systems was gained at Cheyenne and Salt Lake City, Utah.

Present professional interests are in electronics and microcomputer systems. A strong interest in undergraduate and graduate teaching also creates much satisfaction. Research activity has always been agricultural related. The Ph.D. dissertation

was with the microbiology department at the University of Wyoming.

Dr. Ellerbruch is a member of Eta Kappa Nu, Sigma Tau, Phi Kappa Phi, and Tau Beta Pi honor societies. He is a past member of Sigma Xi. Professional memberships are held in NSPE (National Society of Professional Engineers), IEEE (Institute of Electrical and Electronic Engineers), ASEE (American Society of Engineering Educators) and SDES (South Dakota Engineering Society). Memberships are held in Kiwanis and Mt. Calvary Lutheran Church.

The Ellerbruch family includes his wife, Georgan, three daughters and one son. Hobbies include family activities such as sailboating, water skiing and pool, and also square dancing. Spectator sports are also enjoyed.



Robert Kennerknecht
Vice President

Born in Indianapolis, Indiana, 28 December 1931, and raised in East St. Louis, Illinois, he attended Central Catholic High School. It was here that Bob first became interested in electronics helping to build

a Van de Graaff generator for a science fair in St. Louis.

During the Korean War, Bob enlisted in the Navy and served as an electronic technician. He attended the Electronics Material School at Treasure Island, California, where in addition to his studies he performed on the school's award winning drill team. After three years aboard the destroyer U.S.S. *Buck* he mustered out as a second class petty officer.

Bob next attended the City College of San Francisco for his first two years of engineering where he was active in both the newly formed Engineering Society and the Veterans Club. In June 1957, he received his A.A. degree.

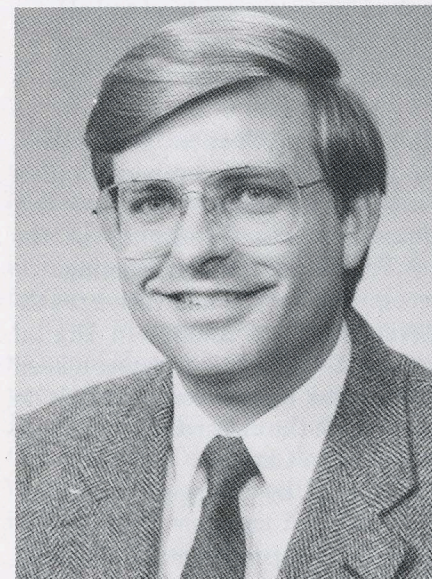
It was then on to Berkeley where he was inducted into Eta Kappa Nu, Mu Chapter and Tau Beta Pi, California Alpha Chapter in 1957. He received his B.S.E. from the University of California at Berkeley in 1959, majoring in electrical engineering. While at Cal, Bob was active in the joint IRE and AIEE student society and in both Eta Kappa Nu and Tau Beta Pi. Taking night classes, Bob earned his M.S.E.E. degree from U.S.C. in 1963. It was while attending U.S.C. that Bob began to work with the Los Angeles Alumni Chapter of Eta Kappa Nu.

Bob has worked as an electronic designer for Aerojet General in Azusa and as both an electronic and servo system designer for Consolidated Systems in Monrovia. Since joining General Dynamics as a Senior Engineer, he has performed primarily as a system dynamic analyst; although he has had some time for both electronic and servo design. He is now an Engineering Staff Specialist on staff to the Director of System Engineering.

Bob has taught Control System Analysis and Design at General Dynamics for 20 years and various

courses in electrical engineering at Polytechnic University of California at Pomona for 15 years.

Bob is a member of both the Corporate and Pomona Division Speakers' Bureaus and has served on the International Board of Directors for Eta Kappa Nu. Bob is a past president of the L.A. Alumni Chapter of Eta Kappa Nu and has served on their student award committee for over 15 years. He is also a member of Tau Beta Pi and a registered engineer.



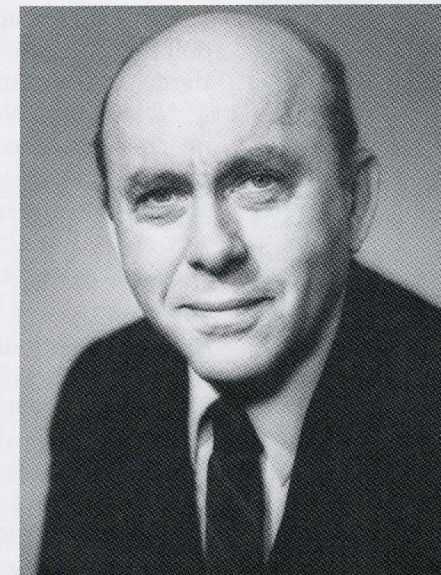
Donald Stoica
Director

Donald S. Stoica is a Senior Staff Engineer at Hughes Aircraft Company in Fullerton, California, where he has worked for the past 13 years. After graduating from California State Polytechnic University (Cal Poly) at Pomona with a BSEE degree, he joined Hughes Aircraft Company as a computer design engineer. His first job was working on a design team which designed a general purpose embedded computer for use in navy military systems. Soon after integrating this computer into a navy display, he had the opportunity to work on the design of the ADCAP torpedo. On this program, he worked on the hardware design of the torpedo sonar, the algo-

rithm design and analysis of the sonar signal processing, and the combined analog, digital, and software design of the torpedo autopilot control system. Soon afterwards, he led the design of a special purpose high performance digital signal processor for use in a tactical sonar system.

During this time, he received his MSEE degree from USC as part of the Hughes fellowship program. Graduate studies included courses ranging from digital signal and image processing, to control systems and robotics. These classes provided an opportunity to blend theoretical approaches with a number of real-world practical problems encountered in the day-to-day design of military systems.

Currently, he is the acting Chapter President of the Eta Kappa Nu Los Angeles Alumni Chapter and is active on the Alton B. Zerby Outstanding Student Selection Committee. In addition, he is a member of Eta Kappa Nu, Phi Kappa Phi, Tau Beta Pi, and IEEE.



Irving Engelson
Director

Dr. Irving Engelson is Staff Director of Technical Activities and Secretary of the Technical Activities

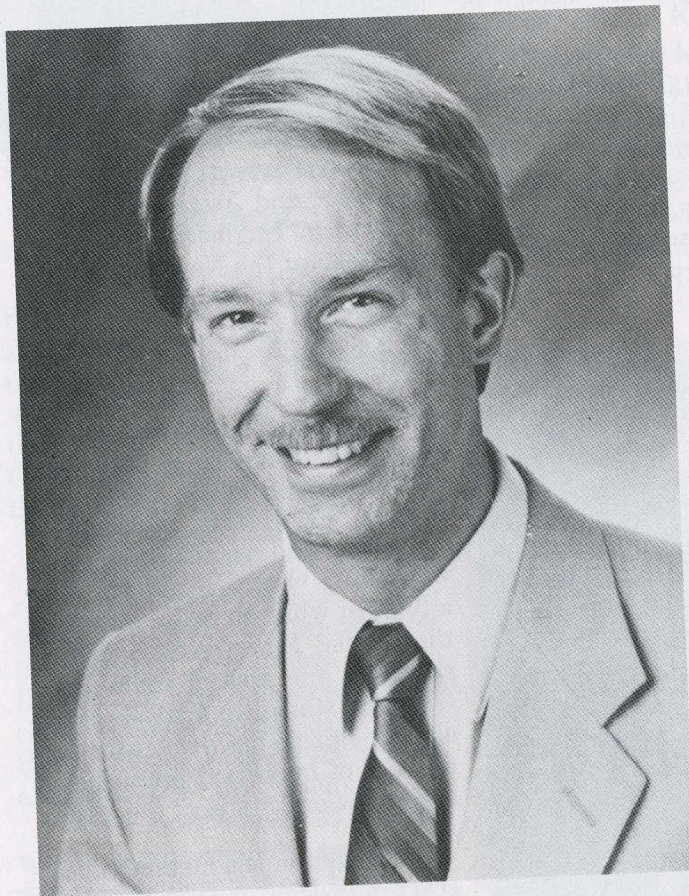
Board of The Institute of Electrical and Electronics Engineers (IEEE). In this capacity, his directorate coordinates the activities of 36 IEEE Societies with a total membership of approximately 300,000 worldwide. He received the B.S. (EE) degree (magna cum laude) from the Polytechnic Institute of Brooklyn, the M.S. degree in electrical engineering from Rutgers University and the Ph.D. degree in electrical engineering from Worcester Polytechnic Institute. He has over two decades of experience in education and industry and has lectured and published on a wide range of topics, including brain function, electrical engineering, computer simulation, technology and education.

Dr. Engelson formerly held a number of academic positions including Professor and Associate Dean of the College of Engineering and Technology at the University of Nebraska, and Associate Professor of Electrical Engineering and Assistant Dean at the New Jersey Institute of Technology. He also held several positions in industry including eight years with RCA in a variety of capacities. He has served as a visiting Research Associate with the Bureau of Research in Neurology and Psychiatry at the New Jersey Neuro-Psychiatric Institute in Princeton, and has done consulting work for industry. He also served as a linguist while on active duty with the United States Army. His research in the area of communications and statistical analysis of bioelectric signals has demonstrated a number of important physiological and behavioral states of the brain.

Dr. Engelson is a member of several professional and honor societies including Sigma Xi, The New York Academy of Sciences, Eta Kappa Nu and Tau Beta Pi. He is presently serving as Chairman of the Eta Kappa Nu Award Organization Committee for the Outstanding Electrical Engineer of the Year and is a non-governmental representative to the Economic and Social Council of the United Nations.

THE C. HOLMES MacDONALD OUTSTANDING TEACHING AWARD

by George Balderston, Past Member HKN Board



David G. Meyer

Dr. David G. Meyer, Assistant Professor of Electrical engineering, was presented with the C. Holmes MacDonald Outstanding Teaching Award for Young Electrical Engineering Professors for 1987 at a regular meeting of Beta Chapter at Purdue University on Wednesday evening, October 7, 1987. The award is presented annually by Eta Kappa Nu and is adminis-

tered by the Philadelphia Alumni Chapter. The winner, officers of Beta Chapter, faculty members, and a representative of Philadelphia Alumni Chapter and International Headquarters met for dinner at the Hotel and Restaurant School prior to the meeting.

Dr. Meyer was recognized for his innovative teaching methods and development of courses in Digital Logic and Microprocessor Design. He expresses a keen interest in his students, and his concern extends to readily available help outside the classroom. He serves as a Faculty Advisor for Beta Chapter.

The award was presented by George Balderston, past International Director and member of the Philadelphia Alumni Chapter. His presentation included the following remarks:

"Eta Kappa Nu, as an international electrical engineering honor society, encourages high academic and professional accomplishments and believes such labors should be rewarded. To this end Eta Kappa Nu sponsors several annual awards.

"In 1972 the Philadelphia Alumni Chapter decided there was a need to recognize outstanding accomplishments in teaching. Thus, the award for Outstanding Young Electrical Engineering Professor was established and endorsed by the international association. The award has subsequently been named the C. Holmes MacDonald Outstanding Teaching Award to honor a charter member of the Philadelphia Alumni Chapter who capped a notable engineering career at Ma Bell with a number of years of university level teaching, and whose help and encouragement were instrumental in establishing the award.

"Dr. David G. Meyer, a very special person to many of you here at Purdue, is the 1987 winner of the C. Holmes MacDonald Outstanding Teaching Award.

"I am sure the people here are more aware of Dr. Meyer's qualifications than I, but let me give him pub-

lic recognition for a few of them.

"In making our selection, we look for teachers who are adept at motivating their students to learn and to become active, contributing individuals both within and beyond their profession. Dr. Meyer's performance in this area is attested by the students and associates who write so glowingly of his abilities.

"But Dr. Meyer imparts much more to his students than dedicated teaching—

He offers much help to students outside the classroom.

His publications are legion.

Through his efforts significant improvements have been made in laboratory and research facilities at the University.

He has been instrumental in development of courses in Digital Logic and Microprocessor System Design.

He has held positions of leadership in The Institute of Electrical and Electronic Engineers.

"Many other things could be mentioned, but I do want to recognize his dedication to aiding the leadership of Beta Chapter here at Purdue.

"In conclusion I wish to state that David G. Meyer is an outstanding example of what an electrical engineering professor should be.

"The Philadelphia Alumni Chapter and the International Headquarters of Eta Kappa Nu are pleased to present the following mementoes to Dr. David G. Meyer, the 1987 winner of the C. Holmes MacDonald Outstanding Teaching Award: 1) an engraved pewter plate; 2) an engrossed certificate, and 3) a \$500 honorarium."

Biography

David George Meyer received the B.S. degree in electrical engineering in 1973, the M.S.E. degree in electrical engineering in 1975, the M.S. degree in computer science in 1979, and the Ph.D. degree in electrical engineering in 1981, all from Purdue University, West Lafayette, Indiana. In 1982, he joined the School of Electrical Engineering at Purdue University, where he is currently an associate professor specializing in advanced architecture microprocessors, computer architecture, acoustics, digital signal processing, parallel processing computer systems, VLSI design, and educational delivery systems.

One of Dr. Meyer's primary goals while at Purdue has been to develop the "best possible approach" for teaching mainstream computer engineering courses and laboratories, particularly at the undergraduate level. To this end, he has developed the "lecture workbook" approach to presenting material in class. Using this technique, students are able to "customize" a "skeleton" set of notes (copies of which are distributed at the beginning of the semester) designed to promote active

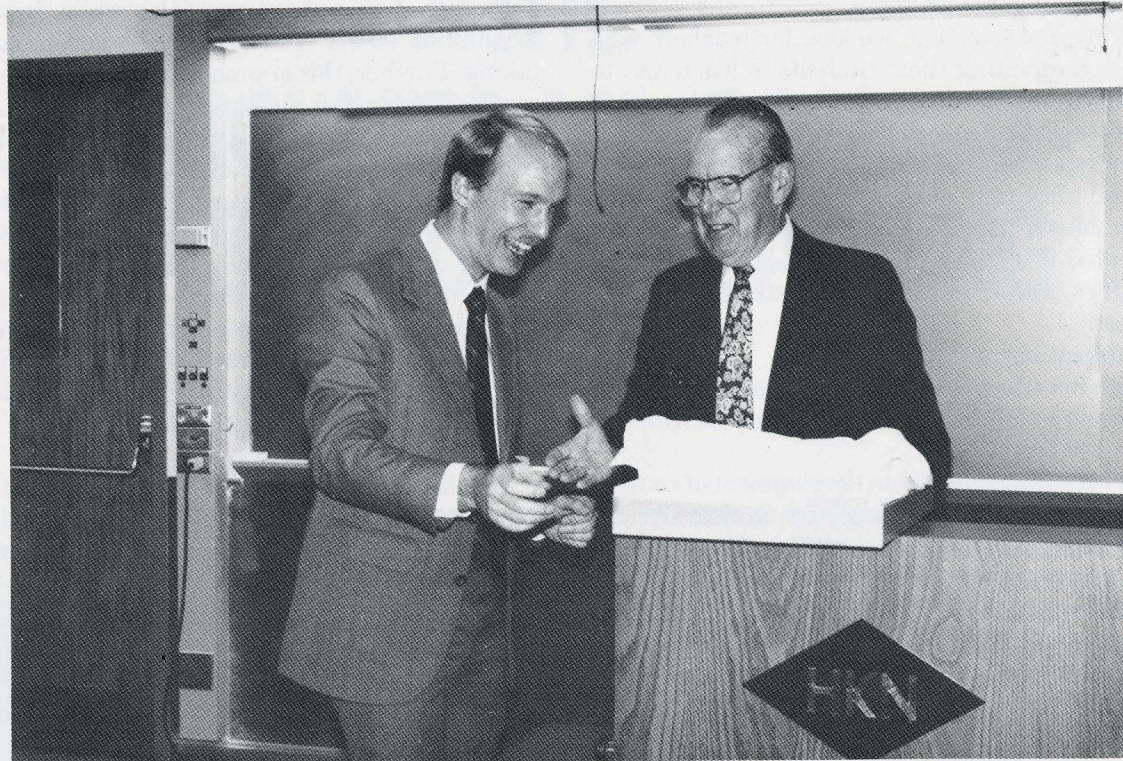
encoding of important material while reducing the "scribbling stress" which normally accompanies note-taking. Further, this approach promotes a more relaxed atmosphere in the classroom and subsequently frees students to participate in classroom discussions. As a result of his innovative instructional techniques, Dr. Meyer has won teaching awards in 1984, 1985, 1986, and 1987. In 1987, he was the national recipient of the Eta Kappa Nu C. Holmes MacDonald Outstanding Teaching Award. In 1986, he was one of 11 national recipients of Digital Equipment Corporation's "Incentives for Excellence" Award. This award has allowed Dr. Meyer the opportunity to improve laboratory facilities and to experiment with interactive laser videodisc instructional delivery systems.

Dr. Meyer has published over 30 technical papers on acoustics, parallel processing system design, audio system engineering, and educational delivery systems; he has presented his work at various conferences throughout the United States. He has authored book chapters on parallel processing and advanced architecture microprocessors, and is currently authoring the book, *Introduction to Microprocessor System Design: Programming and Interfacing*, to be completed in 1989. This book will incorporate many of the innovative techniques Dr. Meyer has developed and utilized in the courses he teaches.

Dr. Meyer has developed two new courses in the computer engineering area; a graduate course on advanced architecture microprocessors, and a senior-level lecture/lab course on embedded microcontrollers. In addition, he has completely revised the introductory lecture/lab course on microprocessors and made major contributions to the introductory lecture/lab course on logic design.

Dr. Meyer has received research grants from IBM for studies in parallel/distributed computing, from the Indiana Corporation for Science and Technology for development of advanced robot control hardware and software, and from Digital Equipment Corporation for development of computer-aided educational delivery systems. He has done consulting in acoustics for both AT&T Bell Laboratories and Electro-Voice, Inc., as well as designed and analyzed sound system installations for various clients. These opportunities for close interaction with industry have enhanced Dr. Meyer's ability to relate course material to the needs of students preparing for the "real world."

Dr. Meyer is a member of The Institute of Electrical and Electronics Engineers (IEEE) professional society, the Audio Engineering Society (AES), the Association of Computing Machinery (ACM), and the American Society for Engineering Education (ASEE). He is also a member of the Eta Kappa Nu electrical engineering honorary society and the Tau Beta Pi engineering honorary society. He has served as a Faculty Advisor for the local student chapters of both HKN and IEEE.



Outstanding Teaching Award Winner, Dr. David G. Meyer, Purdue University, receives \$500 honorarium, inscribed pewter plate and award certificate from Mr. George Balderston, past member, HKN Board of Directors



The C. Holmes MacDonald Outstanding Teaching Award Honorable Mention

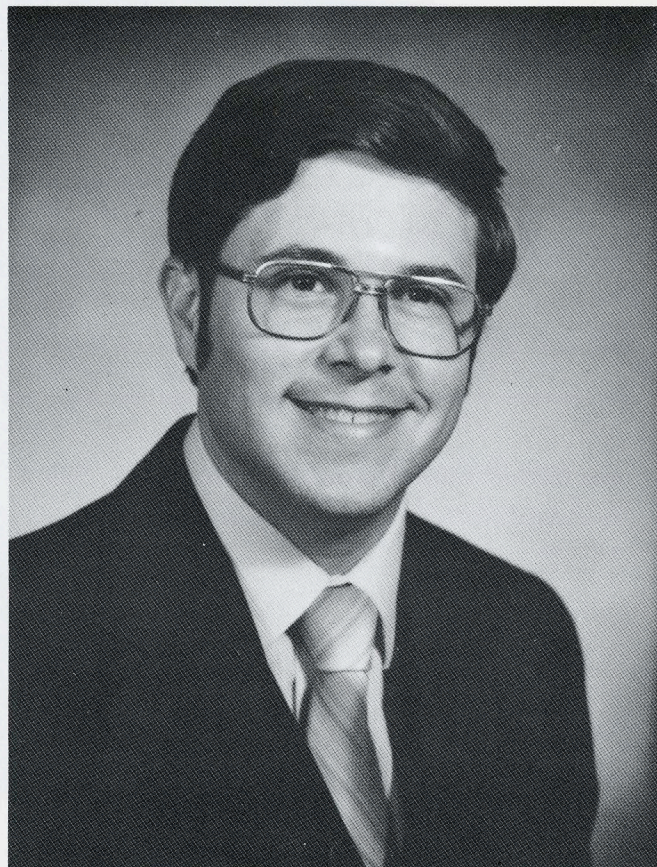
Randy H. Moss is Associate Professor of Electrical Engineering at the University of Missouri-Rolla. He received his B.S.E.E. degree (with high honors) and his M.S.E.E. degree from the University of Arkansas in 1975 and 1977, respectively. He was a National Merit Scholar and an NSF Graduate Fellow. He received the Ph.D. degree in 1981 from the University of Illinois.

Dr. Moss joined the faculty of the University of Missouri-Rolla as Assistant Professor of Electrical Engineering in January 1981, and was promoted to associate professor in 1986. His research interests are in the areas of image processing, pattern recognition, and computer vision. He is especially interested in vision systems for industrial robots, automated inspection systems, and medical applications of image processing and pattern recognition.

Dr. Moss has developed a machine vision course and laboratory at the University of Missouri-Rolla under a grant from the General Electric Foundation. The course covers those image processing and pattern recognition concepts that are of use when the final results are to be used by a machine. Applications include vision systems for industrial robots and automatic visual inspection systems.

He is presently involved in a research project funded by NSF which uses computer vision techniques to aid in the diagnosis of skin cancer. The project is an attempt to have a computer automatically recognize those tumor features most useful in the diagnosis of skin cancer. Dr. Moss is working with a dermatologist on this project.

Dr. Moss is one of the faculty advisors of the Gamma Theta Chapter of Eta Kappa Nu at the University of Missouri-Rolla. He is a member of Phi Kappa Phi, Eta



Randy H. Moss

Kappa Nu, Tau Beta Pi, IEEE, SME, SAE, and the Pattern Recognition Society. He has served as president of the UMR chapter of Sigma Xi and for two years as secretary-treasurer of the Rolla subsection of the IEEE. He is an associate editor of both *Pattern Recognition* and *Computerized Medical Imaging and Graphics*. He serves on the board of directors of the Missouri Incu-Tech Foundation.

Dr. Moss is the recipient of the Tenth Annual Pattern Recognition Society Award, the 1985 St. Louis Section American Institute for Aeronautics and Astronautics Lindbergh Award, the 1987 Society of Manufacturing Engineers Outstanding Young Manufacturing Engineer Award, the 1988 Society of Automotive Engineers Ralph R. Teetor Education Award, the Outstanding Paper Award (coauthor with Dr. N. R. Cox) of the 1988 ASEE Midwest Section Annual Conference, two UMR Faculty Excellence Awards, and a UMR Outstanding Teacher Award.

He currently serves as chairman of the Finance Committee of the First United Methodist Church in Rolla. He is a member of the Kiwanis Club and serves on the board of directors for United Ministries in Higher Education and the Wesley Foundation.

The Moss family includes his wife, Mary (a Ph.D. chemist) and two sons, Benjamin (4-years-old) and Andrew (2-years-old). Hobbies, when time allows, include reading and a small amount of gardening.



Dr. Vladimir Karapetoff

COBBY AND KARY

by
Larry Dwon, P.E.

Editor's Note:

Very few members of Eta Kappa Nu are familiar with Professor Vladimir Karapetoff and his good and charming wife. This is because Dr. Karapetoff passed away some time ago, and Mrs. Karapetoff, because of health reasons had to become inactive. However, there were many years in Eta Kappa Nu when the Karapetoffs were the toast of our Association. They came to all of our Award dinners, gave speeches, played the piano for us and otherwise brought charm to the festivities. It is now my pleasant duty to announce that the Karapetoff's charm will again be present at the Eta Kappa Nu functions, this time for all the years to stretch ahead. Mrs. Karapetoff passed away recently and left a provision in her will for Eta Kappa Nu to receive one hundred thousand dollars to be put in an Eta Kappa Nu trust with the proceeds used to underwrite a special Eminent Member Award for discovery, invention, or creative contribution of unusually significant quality . . . time tested by history.

INTRODUCTION

The purpose of this article is to honor posthumously two distinguished engineers and humanitarians who loved Eta Kappa Nu.

Each year since 1948, when Dr. Vladimir Karapetoff died, I received Christmas letters from Miss R.M. Karapetoff Cobb—beloved wife of my teacher and friend. She died recently so I will not again hear from her. Nevertheless, Kary and Cobby, shall be remembered. Our editor's insert explains the reason.

Lest you feel that I am disrespectful of two lovely people, let me say that Dr. Vladimir Karapetoff and his beloved wife both admonished me for not using their nick names. Throughout the land many other friends were privileged to address Kary thusly, especially members of the New York Alumni Chapter. There, he was a legend. In his later years, when blindness set in Miss R.M. Karapetoff Cobb accompanied him to Eta Kappa Nu affairs. She attended to his

needs with endearing charm. It was obvious why he chose to call her Cobby. Eventually, some of us accepted the privilege to so address this lady who was distinguished as a chemical engineer in her own right. Thus Kary and Cobby should be remembered by Eta Kappa Nu members as approachable people. They would not want it any other way.

Consequently, it is my privilege and humble honor to write as I feel they would have wanted me to do. They were two distinguished and extra-ordinary people.

In one of Cobby's letters, dated January 19, 1948, she wrote as follows: "The time has come to write to the beloved fraternity, not only in thanks for the beautiful wreath, but for all the expressions of sympathy that made me feel how sincerely you share the sense of loss. Eta Kappa Nu meant so much to Kary that it overshadowed almost every other tie he had".

A WORD ABOUT COBBY

Miss R.M. Karapetoff Cobb graduated magna cum laude from Tufts Chemistry Department in 1922. She celebrated her 86th and last birthday in 1987. I feel a personal loss because she was my last living tie to my great teacher at Cornell and my eventual personal friend, mentor and role model.

While time has passed, Miss Cobb's scientific curiosity, fostered by programs at Tufts and MIT together with a research career in new product development for the paper industry, remained vital to the end. She was elected Fellow in her technical society, having started her career with a Phi Beta Kappa key. She was proud of that key as she was of the Eta Kappa Nu pin that Kary gave her.

Miss Cobb's great-grandfather, Sylvanus Cobb, was the foremost Universalist preacher of his time and the founder of Tufts. He also established a Universalist Church in Lyon, Massachusetts of which Cobby was a member.

Miss Cobb wrote to me recently that her father also attended Tufts and wanted to follow in his grandfather's footsteps; but, "He couldn't preach for sour grapes". On the other hand, he could write, and in 1888 he published *American Domestic Architecture* a very popular work that was reprinted in 1979.

Well Cobby leaves us as a sincere friend of Eta Kappa Nu.

A WORD ABOUT KARY

Students of electrical engineering at Cornell from 1904 to 1939 were privileged to have this great inventor, writer, musician and consultant as their teacher/advisor. Not only did I benefit from his wisdom; but, I later was privileged to develop his friendship after graduation from Cornell University in 1935.

KARY LECTURES—Kary was so known throughout the land by his peers; perhaps best by members of the New York Alumni Chapter. Each year for many, there was an annual event known as Kary's Lectures. The talks he gave were varied, more societal and professional in nature than technical. It was

an event anticipated by many engineers who attended the winter meetings of AIEE. Attendance was extra-ordinary.

His most memorable lecture was planned as though it came from the hereafter. Some time before Kary passed away he recorded a final message to his beloved New York Alumni Chapter members. He instructed Cobby to hold the recording until one year after his death. Then she was to give it to me to arrange a hearing at a suitable Eta Kappa Nu function.

I remember the event well. It was in a Greenwich Village restaurant. Ben Lewis was the master of ceremonies, a stickler for having meetings on a strict time schedule. Roger Wilkinson was a speaker. He was to tell us about an Eta Kappa Nu national assembled convention. He showed many slides of convention delegates. Then the house came down as a scantily clad beauty was misrepresented to have been a delegate from California, before Roger knew what was on the screen. Someone slipped it among Roger's slides and his talk did not end on time, as he conjectured what may come next. Needless to say Ben was beside himself.

I was scheduled next to speak about a departed friend. Ben did not know of this plan change either. Without responding to the introduction, Kary's recording was played. Mixed emotions resulted among the participants, but surprise was common. Kary made his comeback with a sobering message:

"DON'T TAKE YOURSELF TOO SERIOUSLY".

KARY'S EARLY BACKGROUND—Kary was born in St. Petersburg, Russia, on January 8, 1876. He was the son of an engineer, Nikita Ivanovitch Karapetoff and Anna Joakimova Ivanova, one of the few Russian women to attend military medical school as a result of a shortage of doctors caused by the Crimean War. Kary's childhood was spent in Tiflin and he graduated from the Imperial Institute of Ways of Communication, St. Petersburg, Russia, in 1897. He received a C.E. degree. In 1902, he earned an MME. From 1899-1900, he studied electrical engineering at the Polytechnical Institute, Darmstadt, Germany.

Before coming to the United States of America in 1902, he was a junior engineer in the Department of Interior Water Ways with headquarters in St. Petersburg. He also instructed electrical engineering, hydraulics, mechanics and physics in three technical schools and a night school during the 1897-1902 period. The Czarist Government then sent him to this country as an engineering apprentice with Westinghouse Electric Corporation, East Pittsburgh, Pa., where he worked one year.

KARY IN USA—It soon became apparent to Kary that the United States offered more for his loyalty than did his native country. He never returned to Europe, and was naturalized March 22, 1909, before the Supreme Court of Tompkins County, N.Y. An interesting sidelight concerning those proceedings came when the government representative asked, "What do you believe that Republicans and Demo-

crats do not believe?" After thinking a while, Professor Karapetoff said, "I believe in women's suffrage, and election of senators by popular vote instead of legislatures".

KARY'S POLITICS—In politics, Kary became an active socialist after he observed the utter disregard for the lives of workmen in industrial plants at the time. As liberals became radical, he tried first to prevent the change. Finally, in 1935, he resigned from the Socialist party. Before this became generally known, a Socialist radical group, in New York, mistakenly invited him to address a large gathering—probably the only liberal leftist group ever to listen to a conservative speaker tell them how wrong it was for people of foreign origin to plan a change in the government of the United States.

At one of Kary's Lectures the subject was "The Dynamics of National Conflicts". His introduction was somewhat like this: "To my younger brothers in Eta Kappa Nu, I am a 'biological parallelist', having spoken and written more than once from this point of view. That is, I believe in a set of ideals in a plane above us, ideals which inspire the best among men, while the masses of human beings move in lower planes parallel to this ideal one, never reaching it. To my older brothers, I may still be the parlor socialist; and lest they listen to what I am about to say, still thinking of me in that light, I should like to explain that I am no longer a socialist. I am now an independent conservative voter, trying to judge current political events and opinions on the basis of first-hand historical facts, advantages of this country in particular and unbiased natural science."

PROFESSIONAL—Kary's professional attainments were numerous. Early in his career, he served in engineering departments of the following companies: Allis Chalmers; Niagara, Lockport and Ontario Power; General Electric; Commonwealth Edison; Gibbs and Hill J.G. White; U.S. Government; Roebbing Sons; Klaxon and Detroit Edison as an employee and/or consultant. He also testified as an expert witness for N.Y. Telephone, General Motors, and Ohio Public Service companies.

Kary urged his students to become registered. He was a registered Professional Engineer in New York State. He advised students to become active in technical and professional societies. He served as chairman and member on general and technical committees of the AIEE, NELA and AAUP. He was Chairman of the Sub-Committee on Physics of the Electrical Insulation Conference, National Research Council, 1928-1935 and Chairman of the Sub-Committee on Monographs, 1935-1938.

TEACHER—Industrial experience is what made Kary such a fine teacher. He brought to the classroom examples of his experience in industry and the profession. Professor Kary, as students respectfully addressed him, was probably best known for his books and teaching career.

Kary wrote several books, many technical papers

and general articles—over two hundred of them. His most famous two-volume textbooks on Experimental Electrical Engineering reached a fourth edition by its acceptance. Other texts were popular too. His last book was "Restricted Relativity Theory in Graphical Treatment and in Hyperbolic Functions". He was working on this manuscript while blind. It was a privilege to make his drawings, calculate his requests and proof some of the material.

But he wrote prolifically on more general subjects as well. He loved to speak, especially to young engineers.

At Cornell, he held the ranks of assistant professor 1904 to 1908 and professor until 1939. During 1912-1915, he was acting head of the electrical engineering department. Upon retirement he became professor emeritus.

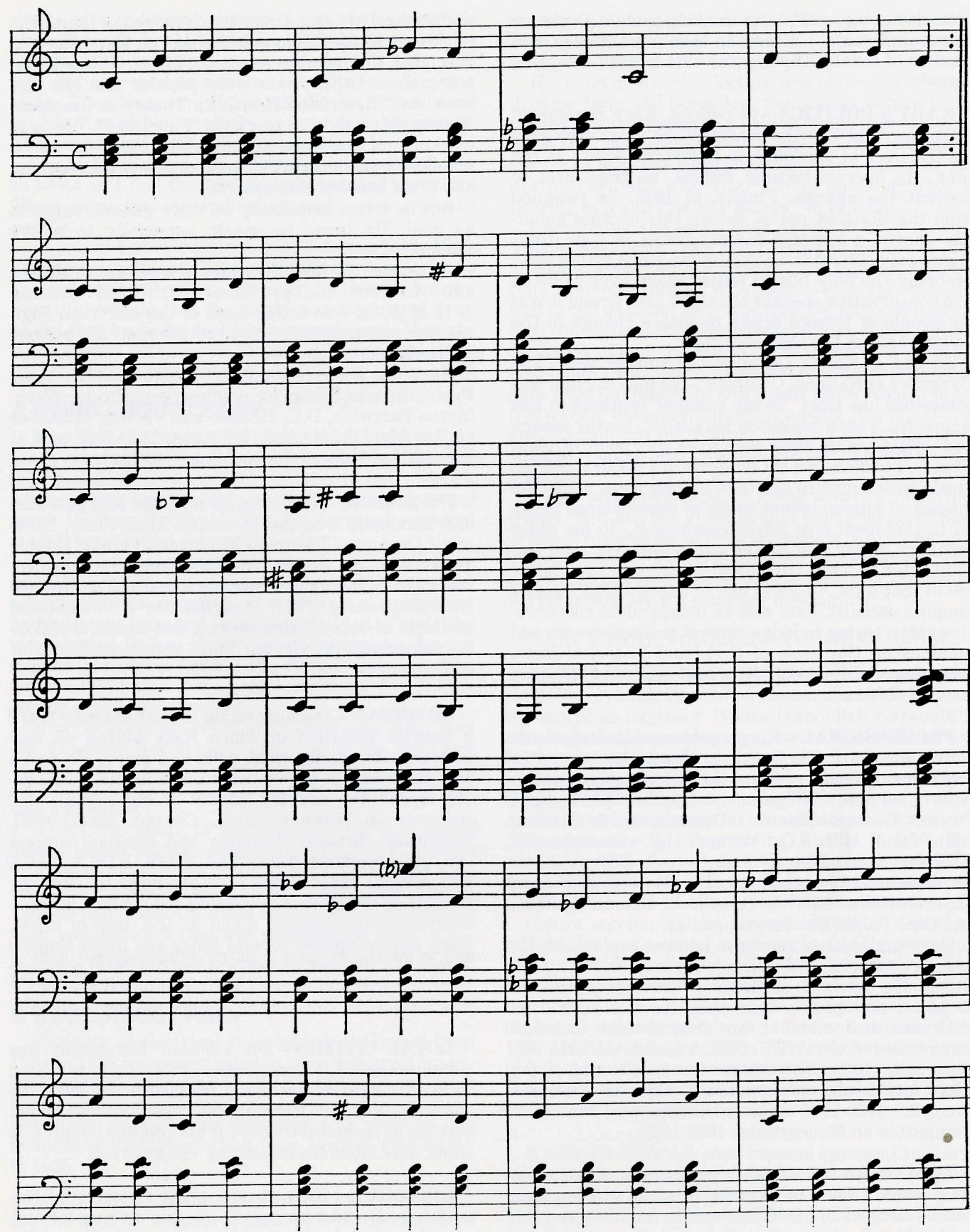
Kary was a non-resident lecturer to the U.S. Army Post-Graduate School for engineering officers, Washington Barracks, D.C. He also was visiting professor at Brooklyn Polytechnic Institute, 1930-1932 and at Stevens Institute of Technology, 1940-1941.

INVENTOR—Kary was an inventor and patentee of a Maximum Demand Indicator, Time Relay, Kinematic Devices of Electrical Machinery, Parallel Double Tongs, Electric Meters, Airplane Compass, Improvements in Synchronous Machines and other devices. He was an early (1931) experimenter with electrical methods of reproducing speech and music, developing apparatus for playing them under conditions of exact control.

MUSICIAN—Demonstrating the latter, I have heard a quartet recorded in which Kary played all four instruments, violin, viola, cello and piano. He was a fine musician. He played many times for HKN groups. He toured the country widely giving recitals and lectures on Wagner, Liszt, Chopin, MacDowell, Schumann, Brahms, Debussy and Russian composers. He broadcast from WJZ, WGY, KDKA, WCA and several other more local stations. In 1922, he developed the famous five string cello, which he demonstrated and lectured about at the drop of a hat. Kary also composed several songs and fitted English words to a number of classical instrumental compositions for solo and choruses. He composed a song for Eta Kappa Nu, to the tune of Lord Jeffery Amherst.

LOYAL CITIZEN—Dr. Vladimir Karapetoff was commissioned Lt. Commander, U.S. Navy, assigned to read classified technical literature. In 1942, he suddenly lost his sight in one eye, but continued serving as technical censor for his adopted country. A short time later, his remaining eye gave out.

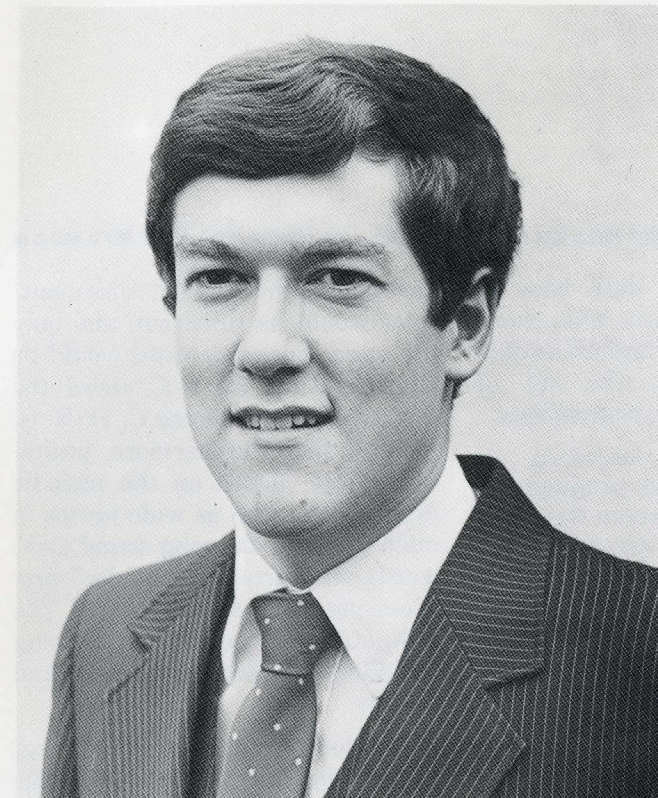
EPILOGUE—Kary was a great teacher, a true professional and a humanist. He was my mentor and my role model. I will never forget him. Eta Kappa Nu should not either. Cobby demonstrated her professionalism by carrying out the wishes of her dear husband.



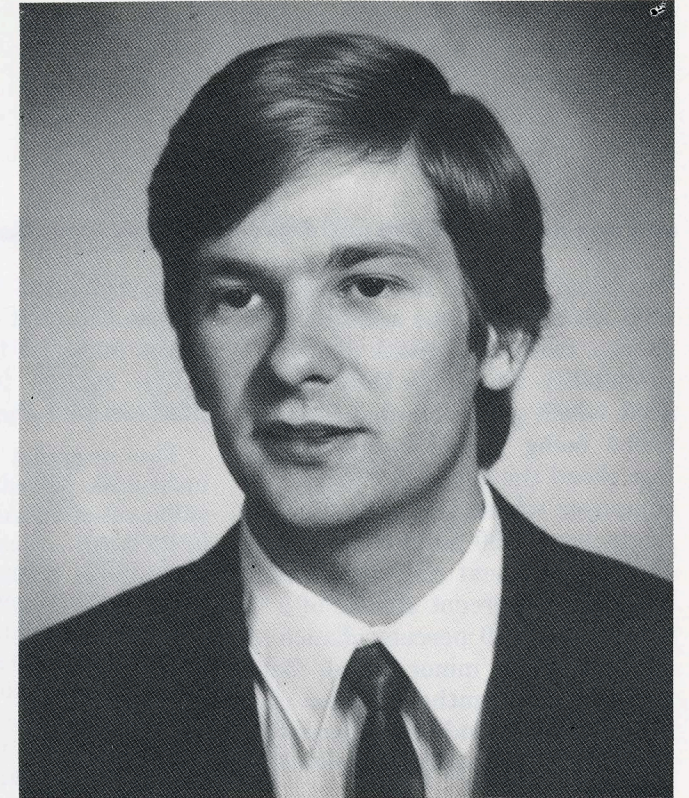
Michael Wisland's Beatles' Music Via Artificial Intelligence

Music Composition Using Artificial Intelligence

by
Christopher Franklin (about Michael Wisland)



Christopher Franklin



Michael Wisland

In recent years, there has been a growing bond between computers and music. There is now a plethora of software and computers on the market capable of playing music through internal speakers or by controlling keyboards and drum machines. This paper delves into another marriage between computers and music, a marriage where the computer writes the music.

Computer composition is much more complicated than having a computer simply play a song. It requires that you teach the computer to be creative. The first step is, of course, to figure out how a human composer writes a song.

To answer the question of "how does one compose music?" we must first consider what a song is made up of. Songs contain three basic

elements: melody, chord progressions (the series of chords which make up the song), and rhythmic figure. Chord progressions and melody play the biggest part in distinguishing one song from another. There are many ways to go about writing a song, but many composers attempt to create songs through the use of chord progressions. The composer will decide on a starting chord and will then pick a succession of chords which produce the sound they desire. This process is not random. It can be shown statistically that composers have a mathematically (probabilistically) predictable style which is different for each person.

The goal is to write a computer program which composes music. To do this the computer must choose its

own chord progressions and put a melody to them. The computer must also produce good music not just a random set of chord progressions. With this in mind Mike Wisland, a graduate student at the University of Missouri-Rolla, decided to have the computer compose music based upon the ideas of composers who are recognized for composing good music. The groups chosen were the Beatles, the Rolling Stones, and Bach. They were chosen for their originality and quality of work, as well as their use of a wide variety of chord progressions.

Wisland gathered data from 10 Beatles songs which reached number one on the pop charts. This data included the chord progression present throughout each song. The data

was analyzed to determine the next chord that one would likely choose from any given chord. A probability base was thus generated which gave the chances of a chord being picked based on the last chord the composer was in. A composer whose last chord was C might have a 60 percent chance of choosing the next chord to be an F chord, a 30 percent chance of a G chord, and a 10 percent chance of choosing an A minor chord. Data was similarly gathered from the Rolling Stones and Bach. However, for this paper only the Beatles work was used.

The next step was to write a program which, using this data base, could write songs, based on the given possible chord progressions. Wisland chose to write the program in Prolog, a programming language designed for artificial intelligence applications. A Prolog program consists of a set of rules and a data base. The computer learns from the information it is given and is capable of making connections between related data. Output may be obtained by asking the computer questions, or "queries." In Wisland's program, asking the right questions causes the computer to compose a song.

The operator starts the composition by entering the desired number of measures (length) in the song and the starting chord. The song shown on p. 22 was chosen to have three groups of eight measures and start in the chord of C. The

computer uses the data base to choose the next chord. This chord is the one with the highest probability rating from the set of possible next chord progressions.

The program as described, up until now, will always produce the same set of chords (given the same first chord)—those with the highest probability rating of occurring. To prevent this repetition ad-nauseam, the concept of fuzzy sets had to be introduced. This simply means that a set of data no longer has rigid boundaries (i.e. some element X does not always belong to some set S). Wisland created fuzzy sets by multiplying the probability rating of chord progression by a random number. This way the "most likely" chord progression will not always be chosen.

The program will continue choosing chords until it reaches the next to last chord. At this point it is time to "end" the song. A song simply cannot end on any given chord. This would have the effect of leaving the listener with a feeling that the song has not ended, or "resolved." Therefore, at this point a new database had to be introduced. This new data is drawn from the ending chord patterns of the songs which were studied.

Once the computer has produced a chord progression, it goes back and fits a melody to it. This melody is made up of a list of notes which fit with each chord. The computer would choose appropriate notes for the melody using basic rules of music

theory. Certain so-called "dissonant" notes would be ruled out, and only the more consonant notes would be allowed. Thus for a C chord the computer might choose C, D, E, G, A, or B flat. Furthermore, limitations were placed on the melodic progression, such as wide jumps in pitch (making the song sound awkward), and certain "forbidden" progressions (such as C to F sharp). The computer then generated the song complete with chord progression and melody.

The song shown on p. 22 was created by the program. For the more musically literate, this song was put into A A B A' form (by sending the first eight bar progression to the melody generator twice to generate the A and A' verses, then a second eight bar progression for the B section). The program assumes four quarter notes to each measure. Those who wish to play the tune are encouraged to invent their own rhythmic figures for the melody since this was not treated by the program.

This article is by no means an exhaustive treatment of computer composition. It is presented as an interest teaser. The author hopes that by reading this article some readers may be persuaded to go on and write more thorough and detailed programs. One final word of warning, however, . . . beware of making your program too intelligent or it may start demanding royalties for its songs!