Title

A Relatively Recent History: Woman Doctoral Graduates in Electrical Engineering and Computer Sciences, 1969-1981

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A Relatively Recent History: Women Doctoral Graduates in Electrical Engineering and Computer Sciences, 1969-1981

By Sheila M. Humphreys

150 Years of Women at Berkeley
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Introduction

In 2023, the Department of Electrical Engineering and Computer Sciences (EECS) celebrated its fifty-year history. Electrical Engineering (EE) was originally in the College of Mechanics. After 1903 EE was in the Department of Mechanical and Electrical Engineering. In 1930 EE separated from Mechanical Engineering and became its own department.[1] However, the history of women doctoral graduates in EECS dates only from 1969. In 1973 the Department of Electrical Engineering merged with Computer Sciences to form a single department. Between 1969 and 1981 at the University of California, Berkeley, ten women earned PhDs in computer science (CS). Not one of the CS women had been able to major in the new discipline of computer science as undergraduates because it was not yet available. In this period seven women earned doctorates in electrical engineering The first woman awarded a doctorate in electrical engineering was Kawthar Zaki in 1969, before the merger of electrical engineering and computer science. Carol Ziegler was the first woman to receive a PhD in computer science. Three of these grad students were single mothers rearing small children. Seven of them were born outside the US. Of the initial seventeen women over half chose careers in academia: Kawthar Zaki, Carol Ziegler, Dana Angluin, Barbara Grosz, Faye Duchin, Estela de Llinas, Rabab Kreidieh Ward, Anne-Louise Radimsky and Patricia Daniels. The women faculty started at lower ranks and advanced more slowly than their male colleagues. In communicating with many of these alumnae, I was struck by their intentional focus on the positive, choosing to develop a thick skin rather than resentment. All but one reported positive relationships with their advisor. Several women related anecdotes of what are now called microaggressions or worse, with wry acceptance of an earlier era. Many of them created and/or participated in mentoring programs for women students or younger women colleagues. All reported great appreciation for their Berkeley education and positive professional careers.

[1] John Torous, BS, electrical engineering, 2007, wrote a history of electrical engineering at Berkeley: "Clarence Cory and a History of Early Electrical Engineering at UC Berkeley." https://eecs.berkeley.edu/wp-content/uploads/2016/04/clarence_cory_history.pdf

First Women PhDs in the Electrical Engineering and Computer Sciences (EECS) Department at UC Berkeley [2]

Year of PhD	Fields of PhD	Advisor
1969	Kawthar Zaki (EE)	Andrew R. Neureuther
1972	Rabab Kreidieh Ward (EE) Carol Alcorn Ziegler (CS)	Otto J. M. Smith Ward D. Maurer
1973	Anne-Louise Radimsky (CS) Faye Duchin (CS)	Philip M. Spira Michael R. Stonebraker
1974	Anne Cottrell (CS) Patricia Daniels (EE)	Richard M. Karp Edward L. Keller
1975	Nancy McDonald (CS)	Michael R. Stonebraker
1976	Ileanna Gross Krumme (EE) Dana Angluin (CS)	Elijah Polak Manuel Blum
1977	Estela Soria de Llinas (EE) Barbara Grosz (CS)	Charles A. Desoer & Jerome Sackman Martin H. Graham
1978	Ana Flora Humes (EE) Karel Youssefi (EE)	Eliahu I. Jury Eugene Wong
1979	Paula Hawthorn (CS) Marie-Anne Neimat (CS)	Michael R. Stonebraker Alan J. Smith
1981	Barbara Simons (CS)	Richard M. Karp

[2] Source: UC Berkeley EECS PhD Dissertations https://www2.eecs.berkeley.edu/Pubs/Dissertations/

Kawthar Zaki (EE MS 1966, PhD ’69). Credit: University of Maryland, College Park

Kawthar Abdelhamid Zaki (1940–) was the first woman to earn a PhD in electrical engineering at UC Berkeley in 1969 and first female professor hired in the College of Engineering at the University of Maryland.[3] Born in Egypt, she came from a large family and worked hard to convince her father “that a girl’s education is important” too. She graduated from Ain Shams University in Cairo with a BS in electrical engineering and specialized in communications, ranking second in the class of 1962 as the only female student. Zaki decided to immigrate with her husband to Berkeley in 1964, where he earned a scholarship for graduate studies. She took classes at a local high school to learn English and earned admission to the PhD program in electrical engineering at UC Berkeley, studying under EE Professor Andrew Neureuther. Her dissertation was titled *Numerical Methods for the Analysis of Scattering from Nonplanar Periodic Structures*.

When her husband got a job offer in Maryland, Zaki applied for and received a teaching position at the University of Maryland (UMD) in College Park in 1970. As a visiting assistant professor, she was the first woman hired in the electrical and computer engineering department, facing immediate resistance from male colleagues who “were very upset…often asking, ‘why is she here?’ ‘Why is she not home raising her kids?’” Zaki found more support from faculty colleagues after winning the 1971 UMD College Park Campus’ George Corcoran Teaching Award,

[3] Dr. Kawthar Zaki was the “First Female Professor Hired Within the College of Engineering at the University of Maryland,” A. James Clark School of Engineering, Department of Electrical and Computer Engineering, April 3, 2017, https://ece.umd.edu/news/story/dr-kawthar-zaki-was-the-firstnbspfemale-professor-hired-within-the-college-of-engineering-at-the

which changed her appointment to a tenure-track assistant professor. In 1991, she received the IEEE Fellow Award for contributions to the analysis of dielectric waveguides and their applications in microwave filters and oscillators. Her research areas span electromagnetic simulation, computer-aided design, and millimeter-waves systems and devices. She has contributed to over 200 publications and holds six patents on filters and dielectric resonators. In 2022, Egypt's Minister of Immigration honored Professor Zaki with a life achievement award.[4]

Rabab Kreidieh Ward (EE PhD 1972, MS 1969). Credit: University of British Columbia

Signal processing pioneer **Rabab (Kreidieh) Ward** (1943–) was the first woman appointed as professor in engineering in both Canada and Zimbabwe. She has published over 500 referred papers and articles, and holds eight patents. Born and raised in Beirut, Lebanon, she graduated from high school with the highest marks only to be denied admission to the American University of Beirut because the Dean of Engineering believed it would "cost them a lot of money to train [her] as a woman…[and] they will not get their investment back."[5]

Kreidieh earned her bachelor's degree in electrical engineering at Cairo University in Egypt in 1966. Resolved to enter academia, she won a full scholarship from the

[4] Women of Egypt Network. "Egypt's Minister of Immigration Awards 1st Woman to Earn a PhD in Electrical Engineering at Berkley (sic) University." February 10, 2022. https://womenofegyptmag.com/2022/02/11/egypts-minister-of-immigration-awards-1st-woman-to-earn-a-phd-in-electrical-engineering-at-berkley-university/

[5] Dr. Behnaz Ghoraani, "The First in Series to Highlight Women in Signal Processing: Rabab Ward," Signal Processing Society, August 2019. https://signalprocessingsociety.org/newsletter/2019/08/first-series-highlight-women-signal-processing-rabab-ward

Lebanese government to study at UC Berkeley where she became the second woman to earn a PhD in Electrical Engineering in 1972. Kreidieh was advised by Otto J. Smith. Her dissertation focused on *Estimation of Economic Systems*. She lived in the International House, where she met her husband Peter Ward, a civil engineer whose new faculty position at the University of British Columbia (UBC) caused their move to Vancouver. After 18 months, Kreidieh was hired as a seasonal lecturer at UBC to teach "whatever courses they had no one to teach. This was the first time that [she] felt women were discriminated against."[6] Her career trajectory changed in 1975 when the University of Rhodesia (now the University of Zimbabwe) hired both Kreidieh and Ward as new engineering faculty. However, political instability from the Rhodesian Bush War forced the family to return to Vancouver in 1979.

Nine years after she completed her PhD, Kreidieh was finally given a tenure-track assistant professor role in 1981. Her research focused on signal, image, and video processing and detection, which contributed to real-life applications in television, medical imaging, and brain computer interfaces. As a trailblazing academic, she co-founded the Society for Canadian Women in Science & Technology and introduced K-12 programs to support girls interested in STEM. She became the first woman in electrical engineering to become a Fellow of the Royal Society of Canada in 1999 and has supervised 47 PhD and over 50 Master's students to date. She has garnered numerous accolades including the Norbert Wiener Society Award (IEEE, 2008), Centennial UBC Dean's Medal of Distinction (2016), and election to the National Academy of Engineering in 2020 for "innovative applications of signal processing to industrial and bioengineering problems." When asked about her most important achievement, Kreidieh replied without hesitation: UBC's Killam Award for Excellence in Mentoring, the university's highest, "is the dearest to my heart."[7]

[6] Ghoraani, ibid.

[7] Ghoraani, ibid.

Carol Alcorn Ziegler (PhD CS 1972). Credit: Eden Seminary

Carol (Alcorn) Ziegler (1936–) was the first woman to earn a PhD in computer science at UC Berkeley in 1972. An only child, Ziegler grew up in Pasadena. Her father was a civil engineering graduate of the California Institute of Technology and her mother taught elementary school. She graduated from Goucher College (then a women's college) in 1956 with a Ford Foundation scholarship, where she majored in math and physics and first became interested in symbols. In 1958, she obtained an MA degree from Stanford in mathematics and math education. After teaching math for five years at Bakersfield College, she won an NSF graduate fellowship to study at Harvard, where she earned an MS in applied physics in 1964. Harvard had no CS department at the time. Then she enrolled at Berkeley in the engineering science PhD program (which later became computer science) and graduated in 1972. Ziegler wrote a dissertation entitled *Individualized, Monitored, Syntax-Directed Computer-Aided Instruction in College and High-School Algebra,* advised by Professor Ward D. Maurer. During graduate study, she taught at California State University, Hayward. From 1972-1974 she taught at California Polytechnic University, Pomona where she was hired to set up the Computer Science Department.

From 1974-1996 she taught computer science at the University of Arkansas at Little Rock, where she set up the department and was the second faculty member

in computer science. After working as a professor of mathematics and computer science, Ziegler added a new career that fulfilled her long-held wish to join the clergy. She entered the Eden Seminary in St. Louis, Missouri from which she obtained her Master of Divinity degree in 1989. After her ordination, Reverend Ziegler served as pastor of St. Paul's United Church of Christ (UCC) in Little Rock for five years. Following her move to California in 1996, Dr. Ziegler was minister at First Congregational Church (UCC) for over twenty years in Barstow, California.

While serving in the ministry, she continued her work in computer science education. Ziegler has published and co-authored five college textbooks on computer programming, including her last, titled *C Programming for Scientists and Engineers with Applications*.[8] Her best-known book is *Programming System Methodologies.*[9]

In a 2009 interview for a local newspaper, Ziegler commented that she and her co-author aimed to improve on what was available to teach programming. Ziegler explained that computer programming and religion have symbolism in common: “I see the Symbolism as the connection between mathematics, computer science, and religion. All three use private symbolic language. In mathematics, symbols are abstract; in computer programming, they are used to create a set of instructions, in religion, they are used to influence people.”[10]

After retiring as a pastor, Ziegler began a desert landscaping business. For many years, she served as a volunteer bookkeeper for Desert Manna, a non-profit charitable organization. Ziegler has not entirely retired. She lives in Barstow, California where she preaches occasionally. Pursuing an interest in archaeology, Ziegler is currently writing a scholarly article on fourth century synagogue mosaics in Galilee.

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[8] Rama Reddy and Carol Ziegler. *C Programming for Scientists and Engineers with Applications*. First Edition. Burlington, MA: Jones and Bartlett, 2009.

[9] Carol A. Ziegler. *Programming System Methodologies.* Englewood Cliffs, NJ*:* Prentice Hall, 1983.

[10] Carol Ziegler, personal communication, April, 2024.

Anne-Louise Guichard (EECS MS ’67, PhD ’73). Credit: Accreditation Board for Engineering and Technology

Anne-Louise (Guichard) Radimsky (1941–2020) was a computing pioneer in America after the Second World War and champion for diversity in science. A native of France, she attended one of the best schools for aerospace engineering, École Nationale Supérieure de l’Aéronautique (known as SUPAERO) and majored in systems theory with a specialization in avionics. She was conducting research at the Centre d’Études et de Recherches en Automatisme when she came across the opportunity to study computer science in the U.S. on a scholarship. She started at UC Berkeley in 1966 and earned a PhD in computer science in 1973 with a dissertation titled *Semantic-Analysis of English Text by Computer,* advised by Professor Philip Spiro. Radimsky was hired at UC Davis as the first woman faculty member in computer science.[11] She also taught upper-division computer science courses at the California State University, Sacramento. Anne-Louise devoted much time to serving professional organizations, acting as a Senior Member of IEEE; Vice-Chair of the ACM (Association for Computing Machinery) Sacramento Chapter; member of the Society of Women Engineers and Sigma Xi. At the Accreditation Board for Engineering and Technology (ABET), Radimsky served as a commissioner on the CAC from 2006 to 2011 and re-joined the Commission

[11] Lori Cameron. “Anne-Louise Guichard Radimsky: A French Computing Pioneer in Post-World War II America who Stands among First Women PhDs in her Field.” IEEE Computer Society, April 18, 2018. https://www.computer.org/publications/tech-news/research/anne-louise-guichard-radimsky-biography-first-women-phds-computer-science

in 2016 for her second five-year term. She had been serving on the CAC Executive Committee (ExCom) as a Member-at-Large since 2019. In her 20 years of service, Radimsky participated in 25 accreditation visits, including several program visits throughout the Middle East.[12]

Faye Duchin (CS PhD 1973). Credit: Rensselaer Polytechnic Institute

Faye Duchin (1944–) grew up in Bayonne, NJ, and graduated in psychology at Cornell.[13] After hitchhiking through Europe and living in Paris during the late 1960s she entered UC Berkeley's CS graduate program in 1969. At first she was discouraged by CS: "I was nearly ready to drop it because computer hardware, software, and analysis weren't really my thing."[14] However, she was able to turn her interest into a viable computer science model and did her dissertation on the recently passed rent control at Berkeley: "It was great, I loved Berkeley."[15] She obtained her PhD in computer science in 1973 with a dissertation titled *Rents, Rent Control, and Non-Profit Rent Schedules: Analysis and Computer Simulation,* advised by future Turing Awardee Michael Stonebraker. Duchin studied

[12] "Remembering Anne-Louise Guichard Radimsky." Accreditation Board for Engineering and Technology (ABET) newsletter, October 2020. https://www.abet.org/remembering-radimsky/

[13] This profile is based on Professor Duchin's former faculty profile at RPI, accessed through Wayback Machine in 2024: https://web.archive.org/web/20161224094141/http://www.economics.rpi.edu/pl/people/faye-duchin

[14] Raymond Lutzky. "Dean Duchin has varied background." RPI Polytechnic Online, Vol. 127, No. 2, September 6, 2006. Published online Nov. 14, 2001. https://web.archive.org/web/20060911223642/http://www.poly.rpi.edu/article_view.php3?view=1041&part=1

[15]

sustainability with an interdisciplinary approach. Her book *Structural Economics: Measuring Change in Technology, Lifestyles, and the Environment*[16] is a good example. From 1977 to 1996, Duchin was on the faculty of New York University, where she worked on computer models with Nobel Laureate in economics Wassily Leontief. She succeeded Leontief as director of the economics research center there. In 1996 Rensselaer Polytechnic Institute (RPI) approached Duchin with an offer to be dean of the School of Humanities and Social Sciences (H&SS).[17] Although she originally had no desire to be dean, her mentor Leontief was nearing retirement and so she accepted the position and became a professor of economics and dean of H&SS at RPI. As dean she urged students to study broadly: "You're getting a fine education in math, and science, and technology, but in order to advance to a position of leadership, you need to have a broad understanding of the world we live in, especially post-September 11."[18]

Duchin's research is concerned with ways of achieving economic development while avoiding environmental disasters. She makes use of mathematical models of individual economies and the world economy to analyze alternative scenarios about the future. She is active in the integration of input-output economics with industrial ecology, rooted in engineering, and with social science approaches to sustainable consumption. Her most recent research focused on the future demand for land and fresh water, particularly for the production of food.

Duchin explained the rationale for her research: "Based on the results of my empirical studies, I became convinced of the need for changes not only in technologies but also in household lifestyles, in particular household decisions regarding diet, housing and transportation…The plausibility and implications of such scenarios need to be explored in a global framework, and I have developed a new model of the world economy for this purpose."[19] Duchin has continued her

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[16] Faye Duchin. *Structura* Lutzky, ibid.
l Economics: Measuring Change in Technology, Lifestyles, and the Environment, First Edition, Washington DC: Island Press, 1998.

[17] Faye Duchin Curriculum Vitae. https://fayeduchin.com/wp-content/uploads/2017/11/fd-shortcv.pdf

[18] Lutzky, ibid.

[19] RPI Faculty Profile. "Faye Duchin, Professor of Economics." Accessed through Wayback Machine in 2024: https://web.archive.org/web/20161224094141/http://www.economics.rpi.edu/pl/people/faye-duchin

work to improve undergraduate education. Her 2024 article focused on developing global competence among community college students through social entrepreneurship and digital skills, so that they can develop possible solutions to "promote the public interest."[20]

Anne Ginzton (BA Math 1966 and CS PhD '74). Credit: 1959 Cubberley High School Yearbook

Anne (Ginzton) Cottrell (1942–) earned a PhD in Computer Science in 1974 at UC Berkeley, after majoring in mathematics at Berkeley as an undergraduate. The daughter of environmentalist and open-space activist, Artemas McCann, and noted Ukrainian engineer, Edward Leonard Ginzton, Anne was the eldest of four children with two younger brothers, Leonard and David, and one sister, Nancy. Anne grew up in an apricot orchard in Los Altos Hills, near Palo Alto, and attended Cubberley High School.

Her parents both graduated from UC Berkeley in 1936. Her mother studied English and education; she taught elementary school in Fresno and later taught adult school in the bay area. Her father studied electrical engineering. Edward Ginzton was a professor of applied physics at Stanford, and a co-founder of Varian Associates, where he later served as chairman of the board. His research focused on the microwave field, including incorporation of klystron tubes in linear

[20] Y.Yu & Faye Duchin. Building a Curriculum to Foster Global Competence and Promote the Public Interest: Social Entrepreneurship and Digital Skills for American Community College Students. *Community College Journal of Research and Practice*, *48*(3), 164–174, 2024. https://doi.org/10.1080/10668926.2022.2064374

accelerators used to probe the basic structure of subatomic matter. Anne remembers that he played number games with the children on car trips and sang Cal fight songs to them at bedtime.

Anne Cottrell loved the "heady experience" of attending Berkeley, including the encouragement of the mathematics teaching assistants and exotic course offerings such as Egyptian hieroglyphs. She took numerical analysis from Professor Derek Lehmer, "a kind and benevolent teacher," in whose class she was introduced to computers.[21] Like other women in her era, she was usually the only female in her computer science classes. She claims to have taken every computer science class the first time it was offered.

At Berkeley Anne met and married Leonard Slater Cottrell, a fellow mathematics major, in 1964. They had one son. During graduate school, Anne traveled back and forth to Los Angeles, where Leonard was working. Her dissertation, advised by Turing Award winner Richard M. Karp and titled *A Lower Bound for the Scholz-Brauer Problem*, was published in Notices of the American Mathematical Society Vol. 20 No. 5 in August 1973.

The couple worked together to compile the oral history of Anne's father into a book titled *Times to Remember: The Life of Edward L. Ginzton*.[22]
Anne loved computer programming and worked for over twenty years at Systems Insight in San Francisco, with challenging work among good friends. She also worked as an usher at the Cirque du Soleil. After she retired, she spent the next twenty years binding books.

[21] Professor D. H. Lehmer was a distinguished mathematician: http://texts.cdlib.org/view?docId=hb4t1nb2bd&doc.view=frames&chunk.id=div00039&toc.depth=1&toc.id=

[22] Anne Ginzton Cottrell and Leonard Slater Cottrell. *Times to Remember: The Life of Edward L. Ginzton.* Berkeley, CA: Blackberry Creek Press, January 1, 1996.

Patricia Daniels (EECS BS 1968 and PhD ’74). Credit: Seattle University

Patricia D. Daniels (1947–), a leader in engineering education, earned a bachelor’s degree in electrical engineering and computer science (EECS) from UC Berkeley in 1968. She was one of two women in her class. Daniels continued at Berkeley to pursue doctoral studies in electrical engineering. Her dissertation was entitled *Vestibular Unit Activity in the Alert Monkey During Visually and Rotationally Induced Eye Movements,* advised by Edward L. Keller. She spent most of her academic career at Seattle University. Daniels is Professor Emerita of electrical and computer engineering (ECE) at Seattle University, where she served as Professor and Chair, as well as Associate Dean of Science and Engineering. She is an Affiliate Professor of Electrical Engineering at the University of Washington. Her professional activities include serving as Program Director for the National Science Foundation (NSF) for Undergraduate Education and a member of Phi Beta Kappa. She was a registered Professional Engineer in the State of California. Daniels also held various positions at the Aerospace Corporation, Westinghouse Aerospace, and Boeing Company.

Professor Daniels has been a leader in engineering education. She chaired the Electrical and Computer Engineering Division of the American Society for Engineering Education (ASEE) and was a member of the Institute of Electrical and Electronics Engineers (IEEE) Committee on Engineering Accreditation Activities. She was an ABET program evaluator from 1988-2021 and served on the Engineering Accreditation Commission (EAC) from 1996-2005, acting as EAC

Chair in 2003-2004. She was an ABET Adjunct Accreditation Director for Engineering from 2012-2014 and is a Fellow of IEEE and ABET.[23]

Nancy H. McDonald (CS PhD '75). Credit: Nancy McDonald on LinkedIn

Nancy Harriet McDonald (1946–2021) earned a BA in Mathematics from Goucher College in 1968, an MS in Computer Science from Harvard University in 1969, and PhD in Computer Science from UC Berkeley in 1975. Nancy had a young son and a daughter at the time and was commuting to Berkeley from San Francisco. She wrote a manual on how to retrieve information from the INGRES database via query diagrams, which was research sponsored by an IBM Fellowship and the National Science Foundation. Nancy worked with Professors Gene Wong and Michael Stonebraker on a team of three grad students, which was developing the relational database Ingres. Nancy and Karel Youssefi, PhD 1978, were two out of the three.[24] Her dissertation was titled *CUPID: A Graphics Oriented Facility for Support of Non-Programmer Interactions with a Data Base*, which was advised by Michael Stonebraker.

After graduation, McDonald went to work in industry. She served as a senior scientist for two years at GTE Telecommunications before pivoting into entrepreneurship and starting a network marketing company in the Tampa, Florida

[23] University of Washington Faculty Profile. "Patricia D. Daniels, Affiliate Professor." https://www.ece.uw.edu/people/patricia-d-daniels/

[24] Jerry Held. "Birth of an Industry," in *Making Databases Work: The Pragmatic Wisdom of Michael Stonebraker,* Association for Computing Machinery and Morgan & Claypool, 2018,99. https://dl.acm.org/doi/book/10.1145/3226595

area. In the 1990s, she co-founded Pre-Paid Legal Services, Inc. and Good Stuff Team, Inc. with her husband Ronald Sweet, who died in 2024. Given their technical backgrounds, they "wanted to make the computer a better tool to help the human side of people [and] understood how important information is" for decision-making.[25] The two companies operated within the legal insurance industry with the goal of connecting people and businesses to affordable, top-rated attorney firms in North America. From 2002-10, McDonald served as Committee Chair for the South Tampa Chamber, an association of more than 600 businesses.

Ileana Krumme (EE BS 1971 and PhD ’76) Credit: Ileana Krumme

Ileana (Teodoru) Krumme (1948–), an only child, was born in Bucharest, Romania. Her father was a civil engineer and her mother was a university professor of philosophy. After two years of college in Romania, Ileana transferred to Berkeley as an undergraduate in 1968. Ileana remembers her first view of the campus being amazed by the size and beauty of the campus–as well as by the freedom to take classes wide away from the declared major.

She enjoyed her electrical engineering classes in which she was invariably the sole woman. She moved directly into the master’s program in EE in 1971. Krumme recalls taking an EE graduate course in Dwinelle Hall, the location of many humanities classes. She was late to class. When she entered the room, the professor

[25] Good Stuff Team, Inc. http://4goodstuff.com/meetus.htm

stopped speaking and said quietly, “This is an electrical engineering class.” Ileana replied “I know,” and sat down.

Fortunately and somewhat unusually, Ileana had her choice of graduate research advisors for projects which interested her. She enjoyed taking classes from Professors Charles Desoer, Aram Thomasian, and Lucien Polak as well as her individual research. At mid-point during her graduate years, she got married. She wrote a dissertation titled *On the Stabilization of Newton-Like Algorithms for Mixed Systems of Equations and Inequalities and for Root-Finding*, directed by Professor Polak. She earned her PhD in 1976. “My years in grad school helped me hone my research skills, taught me to go deep in analyzing a problem and wide in searching for solutions. Taught me how not to be satisfied with a first answer but try to poke holes in it; how not to be satisfied with a first approach but look for others–sometimes out of the box.”[26]

After graduating Ileana was appointed a lecturer in the EE Department for one year, teaching two classes each semester, while her advisor was on sabbatical. However, early on she had already decided that she wanted to work in industry to apply her knowledge to solve real business problems. Her first industry position was at the Bay Area Rapid Transit (BART) where she worked, among others, on the development of a heavy rail simulation capability. This was essential in improving the reliability and efficiency of the system.

She then moved to Chevron where she spent over 30 years consulting in various critical areas to optimize operations and design facilities using advanced modeling and math technologies. For example, she led a project to improve fuel truck scheduling. The system was installed in all Chevron gas stations, reducing run outs and retains; it was also sold to another oil company. She also led a multinational team to build a standardized supply chain management system with advanced optimization features in three plants across three continents. While some of the operations were similar across the plants and thus amenable to one common modeling solution, some of the operations required customized algorithms which

[26] Ileana Krumme, Personal communication, May 20, 2024.

had to fit in the general framework. The system was successfully implemented, leading to a 33% increase in plant throughput.

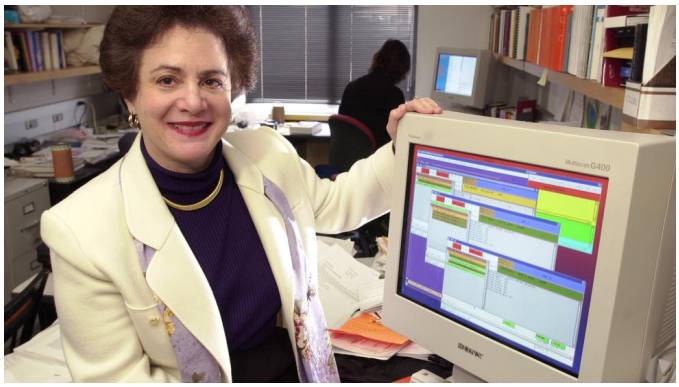
She retired from Chevron in 2011, but continued teaching and tutoring math for many years. Dr. Krumme has two daughters and three grandchildren; both daughters are in STEM careers. After all these years, Ileana is still certain she was in the right classroom.

Dana Angluin (Math BA 1969, CS PhD '76). Credit: Yale University

Dana Angluin (1942–) graduated from UC Berkeley as a math major in 1969. As an undergraduate, she took computing classes in community college because at the time none was offered at Berkeley. Angluin got her start doing undergraduate research with Butler Lampson.[27] She received her PhD in computer science in 1976, advised by Turing Award winner Manuel Blum. Angluin's thesis entitled *An application of the theory of computational complexity to the study of inductive inference* was among the first works to apply computational complexity theory to the field of inductive inference. She joined the Computer Science faculty at Yale University in 1979 and remained there until her retirement in 2021. Angluin is known for foundational research computational learning theory and distributed computing. Her contribution to distributed computing was recognized by the 2020

[27] Butler Lampson earned a PhD at Berkeley in 196 taught at Berkeley from 1967-71. He co-founded Xerox Palo Alto Research Center (PARC). He is best known for contributions to the development and implementation of distributed personal computing https://amturing.acm.org/award_winners/lampson_1142421.cfm

Dijkstra Prize, one of the highest honors in this field. She helped establish the theoretical foundations of Machine Learning. More recently, Angluin focused on the areas of coping with errors in the answers to queries, map-learning by mobile robots, and fundamental questions in modeling the interaction of a teacher and a learner. Dana Angluin garnered three of the highest awards given at Yale for her excellence in teaching: the Dylan Hixon Prize for Teaching Excellence in the Sciences, the Bryne/Sewall Prize for distinguished undergraduate teaching, and the 2020 Phi Beta Kappa DeVane Medal, for which she was chosen by students elected to Phi Beta Kappa.[28]



Barbara Grosz (CS MS 1971, PhD '77). Credit: Harvard University

Barbara Grosz (1948–), Higgins Professor of Natural Sciences at Harvard University and emerita professor of Computer Science, was born in Philadelphia and graduated from Cornell as a math major.

At Berkeley, after some difficult searching for a research advisor, Barbara was ultimately advised by Professor Martin Graham and wrote a thesis titled *The Representation and Use of Focus in Dialogue Understanding* and received her PhD in 1977. Professor Grosz made foundational contributions to the fields of natural-language processing and multi-agent systems. She has been honored for her pioneering work in artificial intelligence. As Dean she led the interdisciplinary Radcliffe Institute of Advanced Studies at Harvard and was Founder of the Center

[28] Yale University Faculty of Arts and Sciences. Faculty Retirement Tributes (2021). https://fas.yale.edu/book/faculty-retirement-tributes-2021/dana-angluin

for the Study of Language and Information. While directing the Radcliffe Institute, she chaired the Harvard Faculty of Arts and Sciences Standing Committee on the Status of Women when it produced the influential report entitled "Women in the Sciences at Harvard."[29] Still very active in the academy, Grosz co-founded Harvard's Embedded Ethics program, which integrates teaching of ethical reasoning into core computer science courses to integrate ethical reasoning and philosophy into the computer science curriculum.[30] Grosz was selected for the Distinguished Alumna Award in Computer Sciences and Engineering at UC Berkeley in 1997. She visited Berkeley as McKay Professor of Computer Science to deliver the McKay Lectures in November 2002. She is a member of the National Academy of Engineering,[31] Fellow of the American Academy of Arts and Sciences, and American Philosophical Society. Among her many awards are the 2009 ACM/AAAI Allen Newell Award; the 2015 International Joint Conference on Artificial Intelligence Award for Research Excellence; and the 2017 Association for Computational Linguistics Lifetime Achievement Award.[32] One would hardly guess that based on a highly distinguished career, Grosz had difficulty finding a doctoral advisor, until Professor Martin Graham stepped in to help.

[29] Barbara J. Grosz. "Report on Women in the Sciences at Harvard, Part I: Junior Faculty and Graduate Students." FAS Standing Committee on the Status of Women, Feb. 13, 1991. https://wff.yale.edu/sites/default/files/files/WomenSciencesHarvard.pdf

[30] Paul Karoff. "Embedding ethics in computer science curriculum." The Harvard Gazette, Jan. 25, 2019. https://news.harvard.edu/gazette/story/2019/01/harvard-works-to-embed-ethics-in-computer-science-curriculum/

[31] Barbara Grosz was elected "for pioneering research in natural language communication between humans and computers and its application to human-computer interaction." https://www.nae.edu/30061/Dr-Barbara-J-Grosz

[32] Barbara J. Grosz CV: https://sfi-edu.s3.amazonaws.com/sfi-edu/production/uploads/people/resumes/grosz-cv.pdf

Estela Soria de Llinas (Physics BS ’66, MEng 1968, EE PhD ’77). Credit: EECS Dept., UC Berkeley

Estela (Soria) de Llinas (1941–) was born in Córdoba, Argentina to a middle-class family and attended the National University of Córdoba on a scholarship in 1960. Before she finished her Bachelor’s, she married a fellow physics student and the couple emigrated to the United States to attend UC Berkeley. She recalls being “almost always the only woman in the physics courses” while completing her bachelor’s degree in physics in 1966.[33] As a graduate student in engineering, she noted that there were no female professors or women students in her courses. Her PhD dissertation, *Parameter Identification in a Cardiovascular System*, dealt with the identification of parameters for a model of the aorta system. She was advised by architecture and civil engineering professor José Nestor Distefano, who suddenly died in 1975 and left her without an advisor. She found EE Professors Charles A. Desoer and Jerome Sackman as advisers and officially graduated 1977.

Llinás and her growing family moved to Pittsburgh, PA when her husband accepted a teaching position at Carnegie Mellon University. She worked as a Systems Engineering Software Consultant at Westinghouse Electric, where she was “the only woman engineer and was often ‘confused’ for a secretary.” She was offered a lecturer position in mechanical engineering at the University of Pittsburgh, Main Campus in 1981. Her research covers systems control, optimization, and stability. By then Llinas had four children. Two years later, at the

[33] This material is based on Magdalena Crowley ‘s in-depth profile of Dr. Estela Llinas for the EECS Department online newsletter (2017): “Alumni Spotlight: Estela Llinas”https://newslettereecs.berkeley.edu/2017/08/alumni-spotlight-estela-llinas/

age of 42, she accepted a tenure-track position as Associate Professor in Engineering and Mathematics at the University of Pittsburgh, Greensburg. Her research covers systems control, optimization, and stability. During her academic career she was a visiting professor at Universidad de Guanajuato, México; University of California, Berkeley; and Universidad Nacional de Córdoba. She also was post-doctoral assistant at the Institute of Hydromechanics in Zürich, Switzerland. Llinas has been a champion for women in the field throughout her career. Professor Llinas has kept in touch with the EECS Department by teaching summer school courses in 1998, 1999, and 2002.

Ana Flora Pereira de Castro Humes (EE MEng ’75, PhD ’78).
Credit: The Brazilian National Council for Scientific and Technological Development (CNPq)

Ana Flora (Pereira de Castro) Humes was born in Brazil and earned her bachelor’s degree at the University of São Paulo (USP)’s Polytechnic School in 1968. She returned to the Institute of Mathematics and Statistics at USP as a Teaching Assistant from 1972-1975. She went on to earn both her Master’s and PhD in Electrical Engineering from UC Berkeley in 1975 and 1978 respectively, with a dissertation titled *General Stability Criteria for Multi-input Multi-output Multidimensional Digital Systems*, advised by control systems pioneer Professor Eliahu Jury.[34] Her research focused on continuous optimization, flexible manufacturing systems, and two-dimensional digital filters, supported by a

[34] Escavador website with information collected from Lattes on 05/24/2023: https://www.escavador.com/sobre/2909049/ana-flora-pereira-de-castro-humes.

fellowship at the São Paulo State Research Support Foundation (FAPESP). She taught at the USP's Institute of Mathematics and Statistics (IME) and co-authored two textbooks, *Noções de Cálculo Numérico* (1984) and *Programação Linear, Um Primeiro Curso* (1986).[35] She met and married fellow Brazilian graduate student Carlos Humes Jr. (EECS PhD 1977) at UC Berkeley, who also enjoyed a long career as full professor at USP. Ana Humes left USP in 1997 for visiting professor roles at Camilo Castelo Branco University (1998-2000) and Mauá Institute of Technology (1999-2001), joining the latter as an instructor in 2002.

Karel Youssefi (EE PhD '78). Credit: Karel Youssefi

The daughter of a US Air Force father, **Karel (Allen) Youssefi** (1951–) was born in Texas, the middle child with two sisters. Growing up, she spent five years in Japan. In high school, she was always strong in mathematics and English and was encouraged by a high school teacher to pursue English. Karel enrolled at Sacramento State University where she met her husband, Kourosh Youssefi, and majored in math. Her introduction to computer science was through a job on campus as a keypunch card operator at the computer center, and she moved up into programming after six months. There were no computer science classes, so she took all the math classes and was one of three women in her physics class of 500. Youssefi graduated with a BS in 1972.

[35] *Noções de Cálculo Numérico* (1984) was authored by A. F. P. C. Humes, et. al. and published by Mcgraw-Hill in São Paulo. *Programação Linear, Um Primeiro Curso* (1986) was authored by C. Humes Junior & A. F. P. C Humes and published by SBMAC (Sociedade Brasileira de Matemática Aplicada e Computacional), Rio de Janeiro.

Karel enjoyed programming and, since her husband was headed to a PhD program in Mechanical Engineering at Berkeley, she also applied for a PhD in EE. During her first semester, she joined a small group at the inception of the relational database project, led by Professors Eugene Wong and Michael Stonebraker. Jerry Held, Nancy McDonald, and Eric Allman were students in the group.[36] Youssefi reports that Professor Wong was very supportive and "I learned a lot from Professor Wong." She enjoyed the freedom of her graduate years and loved Berkeley. Her dissertation was titled *Query Processing for a Relational Database System* and she received the doctorate in 1978. After graduation, the Youssefis moved to Iran with the intention of living there. Karel was employed as professor of computer science at the University of Technology in Tehran, where she taught data structures and database management systems. Their move was ill-timed. That year the Iranian revolution occurred, and universities were shut down. Hostages were taken in the American Embassy in 1979, and the Shah was expelled from Iran before Khomeni created a new government. The Youssefis decided to return to America.[37] Karel Youssefi took a job at Tandem Computers, where she remained during her entire career through two new owners. She started writing code as a programmer in the database area but moved into management in which she excelled. On the software side at Tandem, Youssefi recalls almost half of her group were women. During the 1980s Youssefi visited the Berkeley EECS Department regularly to speak with students. Tandem was acquired by Compaq, which later was purchased by Hewlett-Packard. Karel Youssefi retired in 2005. Her last position was Senior Product Manager in the NonStopDivision with responsibility for database products, overall strategy and executive management.

[36] Jerry Held and Eric Allman became very prominent in the database field.

[37] https://www.britannica.com/event/Iranian-Revolution/Aftermath

Paula Hawthorn (CS PhD 1979). Credit: Paula Hawthorn

Paula (Birdwell) Hawthorn (1943–) was born in Oklahoma City, Oklahoma. Her father was in the military and the family moved around a lot. Paula was always good in math, which was appreciated by her father and a saving grace as she changed schools often. After graduating from the University of Houston as a math major, she had always planned to be a secondary school math teacher—a career that took a detour. After being arrested in a civil rights demonstration she was barred from teaching in Texas because she could not complete her student teaching in the segregated Houston school district. Instead, she went to work at Texaco in Houston where she became intrigued by computers. Paula entered a part-time master's program at the University of Houston with a six-month old baby and soon another child on the way.

When she entered graduate school at Berkeley Hawthorn was a single mother of two. Upon discovering she had young children, her temporary advisor told her she could not be a serious student in the program. As she relates in her oral history, when it became clear she needed to earn money to support two children, she planned to drop out to go to work. She found it impossible to do her assignments using the campus computers in the middle of the night. Her University of Houston professor Steve Sherman intervened: "Paula, you have to stay in school. You have a real future; you must not drop out now." Sherman encouraged her to pursue a

PhD. He guided her to the professor who became her research advisor, Michael Stonebraker, a future Turing Award winner.[38]

Nonetheless, she earned a PhD in the subject of databases in computer science from UC Berkeley under the supervision of Stonebraker in 1979. Her dissertation was titled *Evaluation and Enhancement of the Performance of Relational Database Management Systems*. Hawthorn was a significant contributor to the Ingres database project. With fellow grad students Barbara Simons, Susan Eggers, and Marie-Ann Neimat, she co-founded the graduate student group Women in Computer Science and Engineering (WiCSE).[39] She also co-founded the CS Reentry Program with fellow student Barbara Simons, which encouraged women and minorities who had degrees in other fields to return to school and prepare for a graduate degree in computer science. The CS Reentry Program was successful in preparing a number of women for competitive admission to master's degrees in CS and to some extent, to CS doctoral programs.[40] In 1996, Hawthorn became the first woman honored with the Computer Science Distinguished Alumni Award at Berkeley.

During her career, Hawthorn worked at Hewlett-Packard, Lawrence Berkeley National Laboratory, Britton Lee, Illustra, Informix and consulted for a number of startup companies. She is known for her effectiveness as a manager. A resident of Oakland, Hawthorn continues her activism to prevent gun violence. She is the secretary of Soldiers Against Violence Everywhere (SAVE) Oakland; the Co-Chair of the Oakland/Alameda County Chapter of the Brady Campaign To Prevent Gun Violence; Co-chair of the St. Paul's Episcopal Church (Oakland) Social Justice Committee, and a member of the Oakland Safety and Services Oversight Commission. In 2002, IEEE conducted an oral history of Paula Hawthorn's life and career up to that point.[41] In 2022, a Berkeley CS alumnus, Dr. Michael Olson,

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[38] Paula Hawthorn. An interview conducted by Janet Abbate, IEEE History Center, July 5, 2002. https://ethw.org/Oral-History:Paula_Hawthorn

[39] Sheila Humphreys. "Women in Computer Science and Electrical Engineering: A Network of Our Own."2020. *UC Berkeley: The 150 Women Project*. Retrieved from https://escholarship.org/uc/item/5dx369x7

[40] Sheila Humphreys and Ellen Spertus. "Leveraging an Alternative Source of Computer Scientists: Reentry Programs," ACM SIGSE Bulletin, Vol. 34, No. 2, June 2002.

[41] Paula Hawthorn. ibid.

created the Paula Hawthorn Graduate Fellowship at Berkeley to "help improve gender equity in the historically male-dominated tech world" as his mentor did.[42]

Marie-Anne Neimat (CS PhD 1979). Credit: Marie-Anne Neimat

Marie-Anne Neimat (1951–) was born in Egypt and emigrated with her family to the United States in the 1960s, settling in Southern California when she was 16. Her father was a mechanical engineer. Because she lacked fluency in English, she concentrated on mathematics and science in high school. Neimat graduated from Stanford University in 1972 with a BSc in Mathematics. She earned her PhD in Computer Science from UC Berkeley in 1979. Advised by Professor Alan J. Smith, she wrote a dissertation on *Search Mechanisms for Large Files.* Neimat was an active member of Women in Computer Science and Engineering (WiCSE), the graduate women's organization, at Berkeley.

Neimat has achieved a track record in database innovation. In her last full-time position, she was Vice President of Development at Oracle where she managed development for the Oracle TimesTen In-Memory Database, Oracle Berkeley Database, and Oracle NoSQL Database. Prior to joining Oracle, Neimat was co-founder of TimesTen, Inc., the first company to develop and commercialize an In-Memory Relational Database. There, she served as Vice President of Engineering and Board Member. TimesTen, Inc. was acquired by Oracle in 2005. Prior to co-founding TimesTen, Neimat worked at HP Labs in the early 1990s. There, she

[42] "The Gateway: An Idea Factory for Data Transformation." Berkeley Light the Way Campaign. https://light.berkeley.edu/o/the-gateway-an-idea-factory-for-data-transformation/

managed several database research projects. She holds several patents and is the author of many publications in refereed journals.

Barbara Simons (CS PhD 1981). Photo: Verified Voting

Barbara (Bluestein) Simons (1941–) grew up in Cincinnati, Ohio and attended Wellesley College for one year. As a freshman she became engaged to Jim Simons and transferred to UC Berkeley as a sophomore in 1959 where her husband was studying. In the fall of that year she and her fiancé eloped and then she became pregnant. Barbara followed her husband to Boston where he got a job teaching at MIT, which disrupted her education. He later became chair of Math at SUNY Stony Brook. She began taking computer science classes at Stony Brook and did well, but never received a bachelor's degree. Simons moved to California and began to take computer science classes at Berkeley. After one semester she was admitted to the graduate program in CS theory and was advised by Professor Richard Karp. "I came in by the back door," she admits. Simons earned her PhD in Computer Science in 1981 with a dissertation titled *Scheduling with Release Times and Deadlines*. Simons's research focused on compiler optimization, scheduling theory, and algorithm analysis and design. While one of the few women graduate students in CS at Berkeley, Simons co-founded the women's graduate student

organization Women in Computer Science and Engineering (WiCSE)[43] which continues to meet weekly to the present day. Simons gave the keynote address at the Fortieth Anniversary celebration of the WiCSE student group on campus in 2018. She also co-founded the CS Reentry Program for women and minorities along with Paula Hawthorn, and help from CS graduate students Marie-Anne Neimat and Susan Eggers. The Reentry Program in CS, while successful in preparing women and underrepresented students for admission to graduate study in computer science, ended in 1996 because of the constraints imposed on educational programs based on gender by the passage of Proposition 209.[44]

After graduating Simons joined the Research Division of IBM where she focused on compiler optimization, algorithm analysis and design and scheduling theory. Her work on clock synchronization won an IBM Research Division Award. Over the course of her career, Simons became increasingly engaged with technology policy and regulations. Simons won the Norbert Wiener Award for Professional and Social Responsibility in 1992 "for her work on human rights, military funding, and the UC Berkeley reentry program for women."[45] She founded ACM's US Public Policy Committee ((USACM) in 1993. She became the first woman to win the College of Engineering's Distinguished Alumni Award in 2005. On retirement from IBM in 1998, Simons was elected President of the Association for Computing Machinery (ACM), the nation's largest educational and scientific computing society. Since 2002 she has been advocating for technology which is transparent, safe, secure and accurate. An expert on electronic voting, she published *Broken Ballots: Will Your Vote Count?,* a book on voting machines co-authored with Douglas Jones.[46] She has been on the Board of Advisors of the U.S. Election Assistance Commission since 2008, and she co-authored the report that led to the cancellation of the Department of Defense's Internet voting project (SERVE) in 2004 because of security concerns. She was a member of the National Workshop

[43] Sheila Humphreys. Women in Computer Science and Electrical Engineering: A Network of Our Own. *UC Berkeley: The 150 Women Project*. Retrieved from https://escholarship.org/uc/item/5dx369x7

[44] Sheila Humphreys and Ellen Spertus. ibid.

[45] Computer Professionals for Social Responsibility. "Winners of the Norbert Wiener Award for Professional and Social Responsibility." Jan. 25, 2008. http://cpsr.org/about/wiener/wiener-award/

[46] Douglas Jones and Barbara Simons. *Broken Ballots: Will Your Vote Count?* Stanford: The Center for the Study of Language and Information Publications, 2012.

on Internet Voting, convened by President Clinton, that conducted one of the first studies of Internet Voting and produced a report in 2001. She co-authored the July 2015 report of the U.S. Vote Foundation entitled "The Future of Voting: End-to-End Verifiable Internet Voting."[47] Simons currently serves as Board Chair of the Verified Voting Foundation, a non-profit organization that advocates for legislation to promote safe and transparent voting.[48]

Graduate students Barbara Simons, Paula Hawthorn, and Marie-Anne Neimat in 1977.
Credit: UC Berkeley College of Engineering

Two Women Appointed to Electrical Engineering and Computer Sciences Faculty Seventeen Years Apart

[47] https://www.usvotefoundation.org/E2E-VIV

[48] Barbara Simons. An interview conducted by Janet Abbate, IEEE History Center, July 11, 2002. https://ethw.org/Oral-History:Barbara_Simons

Susan Graham, the first female faculty member in CS at UC Berkeley. Credit: Peg Skorpinski

Included in this paper are profiles of the first two women faculty appointed in EE and CS because they were present during the period covered here. These first two attained their degrees from other institutions. A Stanford PhD graduate, **Susan Lois Graham** (1942–) became the first female faculty member when she was appointed Assistant Professor of Computer Science in 1971 in the College of Letters and Science. Susan Graham was born in Cleveland and raised in New Jersey. Her mother taught third grade and her father was a mechanical engineer. Susan attended Radcliffe College where she concentrated in mathematics before the advent of a computer science degree at Harvard. Her interest in computing was ignited during a summer in Washington D.C., when she got a job at the Federal Power Commission and was handed a manual on Fortran and told to work on a program.

Graham went to Stanford for the doctoral program in computer science initially intending to obtain a master's degree in order to get a better job. "I drifted into a Ph.D. program," she related in a 2002 oral history.[49] She was advised at Stanford by Professors Nickaus Wirth and David Gries.

Graham's appointment to the tiny Computer Science faculty of seven occurred two years before the merger with Electrical Engineering in the College of Engineering. After she joined the College of Engineering, Graham became not only the first

[49] Susan Graham. An interview conducted by Janet Abbate, IEEE History Center, Jul. 10, 2002. https://ethw.org/Oral-History:Susan_Graham

woman faculty member in Computer Science but also the first female faculty member in the entire College of Engineering. After she joined the faculty, Graham married a colleague in Computer Science, Michael Harrison. At the time that her tenure case came up, the administration conducted a nepotism review because that policy prevented two close relatives from appointments in the same department, except by special permission of the Chancellor. Her promotion was approved by Chancellor Albert Bowker.[50] Graham remained the sole woman faculty member in EECS for seventeen years. She commented on her appointment:

I was the first woman in that department, but it was a very small department. Two years later, that department got merged into the one I'm in now (EECS), which is the one in Engineering; so I was transferred into the College of Engineering, and thereby became the first woman faculty member in the College of Engineering.

And it wasn't because they wanted a woman; they inherited me rather than hiring me. That was the case for a long time, that I was the only woman in the college. There were periods when, in other departments, a woman would be hired, be here for a few years, and leave again or not get tenure. I think it was seventeen years before there was another tenured woman in the College of Engineering.[51]

Graham's research has spanned many aspects of programming language implementation, software tools, software development environments, and high-performance computing. She spoke in her oral history of her career satisfaction:

I think that one of the things that's been so exciting in my career is that you could make a difference. You could see the effects of the things you invented—see the consequences, see the benefits—fairly readily. Because it's a field in which there's a lot of change, the field is more open to new ideas, because you can use them. I've really enjoyed being in a field that changes, in which there are new things coming along all the time, and you don't keep drilling down and refining the same thing, even though you might be deepening your understanding. All of a sudden, things

[50] ibid.

[51] ibid.

change, and your assumptions have to change, and the problems change—and I like that."[52]

During her distinguished career Professor Graham has played a pivotal role nationally on key advisory committees: the U.S. President's Information Technology Advisory Committee (PITAC), the President's Council of Advisors on Science and Technology (PCAST). She served as the Chief Computer Scientist for the NSF-sponsored National Partnership for Advanced Computational Infrastructure (NPACI) from 1997 to 2005, and as Vice-Chair and then Chair of the NSF-sponsored Computing Community Consortium.

Currently Graham holds the title of Pehong Chen Distinguished Professor of Electrical Engineering and Computer Science Emerita and special advisor to the Associate Provost of the new College of Computing, Data Science and Society (CDSS) at Berkeley. She advises CDSS research and policy initiatives, particularly in the areas of artificial intelligence and public interest technology. Among the numerous national honors Graham has garnered are: the ACM SIGPLAN Career Programming Language Achievement Award (2000), the ACM Distinguished Service Award (2006), the Harvard Medal (2008), the IEEE von Neumann Medal (2009), the ACM/IEEE Ken Kennedy Award (2011), and the Computing Research Association Distinguished Service Award (2012). She was elected a member of the National Academy of Engineering in 1993 for contributions to the theory and practice of compiler construction and for leadership in the computer science community. From 2016-2020 Professor Graham served four years as Co-Chair of Cal Performances at UC Berkeley, based on her high achievement in technology and cultural philanthropy.

[52] ibid.

Avideh Zakhor, the second female faculty member in EECS at Berkeley. Credit: Peg Skorpinski

Avideh Zakhor (1964–) was hired in 1988 as Assistant Professor of Electrical Engineering, the first woman faculty member in electrical engineering and he second in the EECS Department. In her more than three decades at UC Berkeley, Zakhor has published 70 journal papers and 245 conference papers and contributed significantly to the fields of signal processing, computer vision, and 3D imaging. She has advised 20 PhD students and 52 MS students to date. Professor Zakhor currently holds 17 U.S. patents and co-authored three monographs with her students.

Zakhor was born in Tehran. Her father founded the first button factory in Iran. Avideh was chosen as one of two students from Iran to attend the United World College of the Atlantic in Wales in 1978 under an Iranian government scholarship to complete her last two years of high school. Five months after her arrival the Iranian revolution happened, forcing her family to move from Tehran to Los Angeles in February of 1979. She stayed in the UK for the two-year duration of the scholarship and joined her family in 1980 in Los Angeles to attend California Institute of Technology, where she majored in electrical engineering. As new immigrants to the US it was particularly challenging for her parents to pay the tuition of private schools. Zakor is grateful for a General Motors scholarship and Henry Ford Award to pay for part of her undergraduate tuition. She credits Professor Bill Bridges at Caltech for urging her to apply to graduate school. A

prestigious Hertz Fellowship paved the way for completion of her PhD degree at MIT.

Avideh graduated first in her class at California Institute of Technology in just three years and earned a PhD from MIT. She was appointed Assistant Professor of Electrical Engineering at UC Berkeley. For the twenty-four-year-old assistant professor, gaining the respect of the administrative staff was a challenge. "I didn't feel anything special being the first appointed woman in EE. The main issue I had was to get the staff (particularly the female staff) to take me seriously. At one point, I had to get a senior faculty member to come and introduce me to the staff on the 5th floor of Cory Hall and tell them explicitly that they should do the jobs I ask them to do for my courses."[53] Zakhor was candid in stating an opinion shared by many women, that professional women in STEM with equivalent abilities have to work harder than men due to "this inherent bias" and that women make greater sacrifices in order to balance family and career. "I know a lot of women who deliberately don't choose academic careers in science and engineering, because they see that what it takes to succeed conflicts with their personal goals of raising children and having a family. The ones who choose it anyway sacrifice even more than men in my opinion, because they have to fight against this inherent bias that's ingrained in the system. If the men are working 80 hours a week, you work 85 hours. You have to continually prove that you're better."[54]

Currently, Professor Zakhor holds the Qualcomm Chair of Electrical Engineering Emerita. She has been a brilliant and successful entrepreneur. Zakhor co-founded three companies which have had significant impact on industry. OPC technology was established in 1996 and later acquired by Mentor Graphics in 1998. In 2017 Mentor Graphics was acquired by Siemens and currently Siemens has the largest market share of OPC software in the world. OPC technology supplied Optical Proximity Software to the semiconductor industry to enhance yield in the lithography stage of integrated circuit manufacturing. Her second company UrbanScan Inc. was founded in 2005 and acquired by Google in 2007. UrbanScan

[53] Avideh Zakhor, Personal Communication, February, 2016.

[54] Bonnie Azab Powell. "The Hungry Mind: Professor Avideh Zakhor." UC Berkeley News, Apr. 2005.

Inc. was founded in 2005 and acquired by Google in 2007. UrbanScan commercialized the first large scale automatic urban 3D mapping system developed in the Zakhor lab, which was later used for 3D modeling of buildings in 3D Google Earth. She also founded Indoor Reality in 2015 to develop technologies for rapid 3D mapping and visualization of buildings and assets. Indoor Reality was acquired by a large European construction supplies company in 2019 with more than 33,000 employees in 120 countries. Among her many honors are: the 1992 Presidential Young Investigator Award from President George Herbert Walker Bush; the 2022 Winner of Phase 2 Department of Energy E-Robot competition; 2018 Electronic Imaging Scientist of the year;[55] 2018 Scientist of the Year, International Achievement Research Center; and the 2004 Okawa Foundation Prize. She was elected as a Fellow of the IEEE in 2002 and was listed as "50 women in Robotics you need to know" by Women in Robotics in 2022.[56]

Conclusion

The 150W History Project salutes these brilliant women pioneers in electrical engineering and computer science at Berkeley. They are existence proofs, whose stories animate a unique chapter in the ongoing history of women at Berkeley. Their resilience richly deserves recognition as do their pathbreaking careers. Moreover, each in her own way individually worked to advance women. Their research, teaching and mentoring of younger women have opened doors for recent and future generations of women computer scientists and electrical engineers at UC Berkeley and throughout the world.

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I wish especially to thank our 150W History Project Research Assistant, Mary Tan, a 2020 BA in Political Economy graduate of UC Berkeley, for her significant contributions to our work. Mary wrote two essays for the collection and helped our 150W team with the preparation of many UC departmental histories, now posted in

[55] In 2018, Avideh Zakhor was named Electronic Imaging Scientist of the Year by the Society for Imaging Science and Technology for her many important contributions to signal processing, computer vision, and 3D imaging.

[56] UC Berkeley Faculty Profile. "Avideh Zakhor." https://www2.eecs.berkeley.edu/Faculty/Homepages/zakhor.html

the California Digital Library. Her digital research for this essay has been invaluable. The data painstakingly compiled by Dr. Anne J. MacLachlan, Senior Researcher at the Center for Studies in Higher Education, UCB, on women receiving PhDs from 1898-1969 have provided a difficult to obtain and extraordinary source for this and other 150W essays I have written on Berkeley women doctorates in astronomy, botany and zoology. My EECS colleague Magdalene Crowley wrote a long, vividly detailed biographical profile of Estela Llinas, on which mine is based. The IEEE Oral Histories of Paula Hawthorn, Barbara Simons, and Susan Graham, conducted by Janet Abbate, fill in the personal details of their background and professional lives, told in their own voices. Megan Hobbs, UCB College of Engineering, and Sandi Bohlein, Eden Seminary, helped me locate individual alumnae. Most of all, I am extremely grateful to the EE and CS alumnae who took the time to speak with me and to review their profiles: Carole Zeigler, Anne Cottrell, Ileana Krumme, Pat Daniels, Karel Youssefi, Marie-Ann Neimat, Paula Hawthorn, Barbara Simons and Professors Susan Graham and Avideh Zakhor. All errors are mine; corrections are welcome.

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