



CHARLES CONCORDIA

1908–2003

Elected in 1978

“For contributions in the field of analysis of rotating equipment and power systems performance, control, and reliability.”

BY PAUL DE MELLO

CHARLES CONCORDIA, one of the world’s best-known power systems engineers, passed away in Venice, Florida, on Christmas night 2003 at the age of 95.

In July 2003, I was the recipient of the Charles Concordia Power Systems Award, an award sponsored by the General Electric Company in honor of one of its greatest engineers, Charles Concordia. “Charlie,” as he was known, presented the award himself—an act of unusual dedication since at that point in his long career he was almost completely blind. He was assisted by his nephew and namesake, who accompanied his uncle.

At that meeting in Toronto, Charlie also addressed the Institute of Electrical and Electronics Engineers (IEEE) Power Engineering Society’s System Dynamic Performance Committee, and he did so with great clarity, touching on the major milestones achieved by the power industry in the past century.

Charles Concordia was born in Schenectady, New York, on June 20, 1908, the youngest of three brothers. His father was a music teacher who imbued the family with music skills and appreciation. The family lost their father when Charlie was 6, after which he and his brothers grew up in a one-parent family with all the struggles this implies. Charlie was uncommonly interested in science and mechanical gadgets as a child, particularly radio and TV in their embryonic years. He became

a young radio ham at a time when rectifiers were connected to bedsprings and communication was in code. Charlie also built a crude TV set before graduating from high school.

While still in high school he earned a living doing sundry jobs, including collecting bills. He also supplemented high school work with evening courses and by tutoring mathematics to Union College students many years his senior.

In 1926, at the age of 18, convinced he knew more than many college professors, he gave up college in favor of a job with General Electric at its Schenectady laboratories. His unusual talent was quickly recognized, and his supervisors encouraged him to take additional courses of his choice at Union College.

At the GE labs he worked in instrumentation development, magnetic materials testing, and even wind measuring equipment. After four years of lab assignments, Charlie enrolled in GE's advanced engineering course, a program offered to only the most promising college graduates after they had finished the GE test engineering program. In that program advanced engineering theory was honed to the rigors of the real world. He was one of nine students selected to complete the three-year course out of an initial group of 30. This was at the beginning of the 1929 Great Depression, when many young engineers were let go.

In 1934 he joined General Electric's Central Station Engineering Department (later called Electric Utility Engineering Department) in Schenectady's Building 2. This group of engineering luminaries, first led by Dave Jones and later by Sel Crary, was at the forefront of international power systems engineering. It was full of challenges in the broadest definition of systems engineering, including its electrical, mechanical, and control dimension—challenges that extended from power generation to transmission, distribution, and utilization.

Because of his unusually keen insight into complex technical problems, Charlie was in constant demand by various GE manufacturing departments, to tackle first-of-a kind problems in protection, control, and reliability.

World War II brought special research and development demands, particularly for generators and turbines for naval vessels and superchargers for airplanes. Charlie's expertise led to innovations in the early use of electric drives for ships.

In the 1940s, Charlie Concordia undertook some of his most important work—that is, pioneering the analysis of synchronous and induction machines and their effect on system stability. These contributions took advantage of the subsequent rapid progression in analytical tools, beginning with analog system models (network analyzers) and mechanical differential analyzers, which later gave way to the exploding power of digital computation technology. These contributions fostered successful networking and interconnection of U.S. electrical power systems.

In 1951 he published his book, *Synchronous Machines: Theory and Performance* (John Wiley & Sons), which remains a basic reference on the dynamic performance of rotating machinery.

His contributions to professional societies, both U.S. and international, are too numerous to cite in their entirety. In 1940 he served as chairman of the American Institute of Electrical Engineers (AIEE; predecessor to the Institute of Electrical and Electronics Engineers, IEEE) subcommittee on large-scale computer devices. In 1947 he chaired the first committee on computing devices, which eventually evolved into the IEEE's Computer Society.

Charlie published 130 technical papers, was awarded six patents, and was granted an honorary doctorate of science degree from Union College in 1971 and another from Iowa State University in 1993. He retired from General Electric in 1973 but continued consulting to companies worldwide and continued his contribution to technical societies.

Charlie was a member of the U.S. National Committee of CIGRE, served as chairman of the CIGRE Committee on Power System Planning and Operation for nine years, and was made an honorary member of CIGRE, having attended its biennial meetings in Paris for several decades, including the 2002 session at age 94.

He received many awards, including the 1942 GE Coffin Award for contributions to the analysis of wind tunnel drives; the 1961 AIEE Lamme Medal for achievements in the development of electrical machinery; the 1973 GE Steinmetz Award for technical achievement; the 1984 IEEE Centennial Medal for contributions to the Electric Power Discipline; the 1989 U.S. CIGRE National Committee Phillip Sporn Award for career contributions to the achievement of the concept of system integration in the theory, design, and operation of large high-voltage power systems; the 1992 Power-Life Award for contributions to the harmonious development of man and environment; and the 1999 IEEE Medal of Honor for outstanding contributions in power system dynamics.

I worked with Charles Concordia for 14 years in the Analytical Engineering Section of the Electric Utility Engineering Operation at General Electric in Schenectady. As their lead consultant, he was always available to give sound advice on approaches to problems. He was a great teacher and had an amazing ability to get to a problem's essentials with his powerful "back of the envelope" approach, which quickly gave him the expected range of answers.

He was also an outstanding mathematician and delighted in the pursuit of mathematical riddles. From him I learned about such things as the Golden Ratio and Fibonacci Series. His confidence, as a consultant, came from his being a self-learner.

During the late 1950s and 1960s Charlie was famous for being the only owner of a Silver Cloud Rolls Royce in Schenectady.

Behind every great man there usually is a great woman. In 1948 Charlie married Frances Buttler, who predeceased him at age 88 in June 1988. They were married 53 years, and her passing was a major blow to Charlie. His nephew, Chuck, who lived in Boston helped him greatly after Fran's death and into the last years of his life. Chuck shared these additional tidbits with me that give another dimension to Charlie's personality:

Charlie loved to travel, he hiked all the peaks in the Adirondacks, and on his last trip to Paris he walked every street and described them vividly even though he could no longer see well. He went to Hawaii in the 1930s, visiting the islands by small boat and walking the islands a week at a time.

Charlie knew French like a native; the hotel clerk said he sounded like he came from South France. He could converse in at least six other languages and knew greetings and phrases in 10 or more languages.

He could quote from the Bible and had read it in Greek to understand it better.

He knew Shakespeare in the same detail as the Bible. He quoted poetry on any subject.

Charlie and his two brothers had a great interest in photography, both in taking pictures and developing them.

He would try eating anything from mushrooms in the woods to various kinds of worms and bugs. In his young days he varied his weight from 120 to 160 pounds to see what "felt" better. He also tried sleeping from 2 to 10 hours a night to find the ideal night's sleep.

We salute Charlie for an exceptionally gifted and giving life on earth. For those with strong beliefs in eternity of the spirit, I share a quote from Tagore, the famous Bengali poet-philosopher: "Death is not extinguishing the light but putting out the candle because the dawn has come." And another quote from Rossiter Raymond: "Life is eternal and love is immortal and death is only a horizon, and a horizon is nothing save the limit of our sight."

I thank Dick Schulz, Ed Owen, and Virginia Sulzberger for their help in supplying information on Charles Concordia's life.