

In Memoriam

Walter Richard Evans

(15 January 1920 – 10 July 1999)

Walter Evans, brilliant electrical engineer, developer of the Root-Locus Method, author, founder and president of The Spirule Company, inspiring mentor, husband, father, and volunteer, was influential in many people's lives. He had a way of taking complex problems, finding answers to them, and communicating the process to people of more ordinary intellectual ability. The practicality and simplicity of his ideas made Root-Locus Analysis a major advancement in the development of feedback control systems and dynamics systems. Mr. Evans was awarded the prestigious Rufus Oldenburger Medal by the American Society of Mechanical Engineers in 1987, and the Richard E. Bellman Control Heritage Award by the American Automatic Control Council in 1988. Although a genius, he never looked down on others. He sought to teach, instruct, be a model, and serve.



Walter Evans receiving an award at Washington University in 1990.

Evans was born in Saint Louis, Missouri, and his love of math began at an early age. His father was an engineer, and Walt knew when he was young that he wanted to be one, too. He learned to play chess from his grandmother, Eveline Burgess, U.S. Women's Champion for thirty years, 1906-1936, thus enhancing his ability to think a problem through many steps to a solution. Walt's widow, Arline, recalls sitting in front of him in geometry class when they were sophomores in high school, where he would bring in models to prove his answers.

Walt earned his B.S. in Electrical Engineering from Washington University in St. Louis in 1941, completed the three-year Advanced Engineering Training Program at the General Electric Company in 1944, worked as an instructor at Washington University from 1946 to 1948, and obtained his M.S. in Electrical Engineering from the University of California, Los Angeles, in 1951. His thoughts on learning and teaching are reflected in these quotes:

“The main key to learning, in my opinion, is to treat the problem as a game using all the simplifications possible to get the approximate answer.”

“...it seems to me the real bulk of learning takes place in self study and problem solving with a lot of positive feedback around that loop. The function of the teacher is to pressure the lazy, inspire the bored, deflate the cocky, encourage the timid, detect and correct individual flaws, and broaden the viewpoint of all.”

In 1948, John R. Moore offered Walt a summer job (which turned into a

Root-Locus Theory:

“The roots of a dynamic system's characteristic equation reveal directly and quantitatively the natural behavior it will have – at what frequencies it will vibrate and how quickly the vibrations will damp out. By plotting the locus of the characteristic roots, versus the design parameter being chosen, one can see precisely which values will give good behavior and which will not.... The quick, direct display of behavior characteristics and the powerful, immediate dynamic insight this provides gives Evans' method its central role. Moreover, root loci can be sketched quite accurately in seconds, by eye, using clever sketching rules that Evans developed.... For getting things precise where it is critical to do so, Evans invented the Spirule, with which one can get almost three-significant-figure accuracy, again in seconds.... Thus it is that even today, with great computing power all around us, we typically think about a new control system design in terms of the locus of its roots, which we can sketch in seconds. Then we let our computers work out the details and plot them for us.” Dr. Robert H. Cannon, Jr. (speech at the Oldenburger Award Ceremony). 

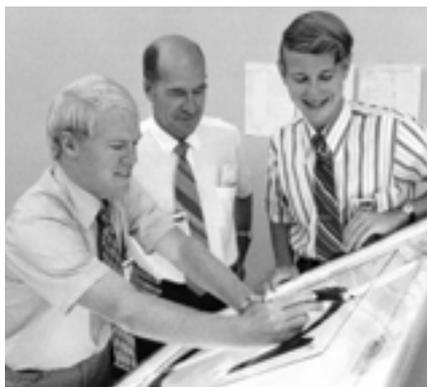
full-time job) at Autonetics, a division of North American Aviation (now Rockwell International) in southern California. There, in a class Mr. Evans was teaching, a student asked what would happen to a typical control system if a certain quadratic approximation broke down. This was the inspiration for Root Locus. Dr. Robert H. Cannon, Jr., Chairman of the Aeronautics and Astronautics Department at Stanford University when Walter Evans was awarded the Rufus Oldenburger Medal, noted, "At North American Aviation's Aerophysics Laboratory where Evans worked, it (the Root-Locus Method) had already become the primary method for designing automatic pilots for high performance aircraft and for the X10 pilotless missile, which was at the time the first operational supersonic aircraft – either piloted or unpiloted."

Don Bently, Founder, Owner, Chairman, and Chief Executive Officer of Bently Nevada, who also worked for John Moore, recalls, "Walt was a most influential person in both my career and in the companies I have founded. While at North American Aviation during the 1950s, it was my privilege to work alongside Walt doing important work on advanced controls for inertial guidance systems. Some of this work was used in the Polaris submarine program that sent U.S. subs beneath the Polar ice cap.... Walt's work on Root-Locus Theory found direct application to much of the work I have been involved with over the past forty-four years, by helping me characterize the behavior of rotating machinery. Walt was a very capable teacher at imparting advanced control theory. In fact, an item I am very proud to have in my personal library is a copy of Walt's book Control-System Dynamics, published in 1954 and signed by

Walt himself. It continues to influence ongoing work today, such as a new fluid bearing that I invented and is now being commercialized."

Walt worked on the technical staff of the Guidance and Control Department of the Re-Entry Systems Operation of the Ford Aeronautic Company from 1959 to 1971, and then returned to Autonetics, where he worked on the technical staff of the Strategic Systems Division until his retirement in 1980.

The Rufus Oldenburger Medal was awarded to him in recognition of his significant contributions and outstanding achievements in the field of automatic control, including his development of the Root-Locus Method, the Spirule (coined as a combination of the words "Spiral" and "Slide Rule"), and his book, Control-System Dynamics.



Evans with his sons Greg, left, and Gary, right, in 1972.

Walter was not only a genius of the first degree, he was also a humanitarian. He loved his family (wife, four children, and grandchildren) and his community. He volunteered in the Boy Scouts of America, the United Way, and his church. His daughter Nancy recalls, "He did things differently and would think 'outside the box'; he encouraged us kids to think for ourselves."

His son Greg said, "I remember some of [Dad's] ideas didn't catch on at the time: spray painting tennis balls

bright yellow and orange to improve their visibility, mounting wheels on luggage to enhance their transportability, and staggering work hours to ease traffic congestion. Let's face it, [Dad was] often ahead of the times."

Even after he had a stroke and was partially paralyzed, he was able to teach and encourage others. His daughter Nancy said that he played chess at the senior center and taught the young volunteers to play. When the game was half over, he would turn the board around and play the other side, thus giving them a chance to win. His colleague and friend, Frank Pelton, concludes, "The world has lost a great technological genius. May he rest in peace." ☺



"The Spirule is a plastic device which permits rapid addition of angles or multiplication of lengths of vectors. The Spirule consists of an arm and disk held together with a light friction fit by a special eyelet, which also serves as a pivot point. On a Root-Locus plot, the pivot point is placed at a trial s point and the arm rotated, with respect to the disk, through each of the vector angles, to obtain their sum. A logarithmic spiral curve on the arm permits the logarithm of a vector length to be obtained as an angle, so that the addition of such angles corresponds to the addition of logarithms. The Spirule can also be used in plotting vectors or as a circular slide rule." (Page 237, Control-System Dynamics, McGraw-Hill, 1954.) ☺