Title: Into Stability

Subtitle: Walter R. Evans and the Story of Root Locus

Author: Gregory W. Evans

Abstract:

Into Stability tells the story of Walter R. Evans and the development of the root-locus method, one of the most widely used tools in modern control-system design. Created in 1948 while Evans was teaching servomechanism theory and later refined at North American Aviation's Aerophysics Laboratory, the method provided engineers with a powerful graphical way to understand how the roots of a system's characteristic equation move as system parameters change. By linking mathematical analysis with engineering intuition, the root-locus method transformed the practical design of feedback control systems.

Drawing on archival correspondence, technical papers, and personal recollections, the book places Evans's work within the broader emergence of modern control engineering during the early Cold War. It traces the intellectual origins of the method, the engineering culture of North American Aviation's Aerophysics Laboratory, and the rapid spread of root-locus concepts through textbooks, classrooms, and aerospace applications.

Part technical history and part biography, *Into Stability* describes how a pedagogical insight became a foundational tool of modern engineering and illuminates the community of engineers who helped shape the early field of automatic control.

- **Keywords**
- Control System History
- Engineering breakthroughs
- Control Theory Pioneers
- Hitory of Engineering Innovation
- Feedback System Design History
- Inertial Navigation
- Waahington University in St. Louis
- General Electric Advanced Course
- Aerophysics Laboratory

INTO STABILITY

WALTER R. EVANS
and the
STORY OF ROOT LOCUS

GREGORY W. EVANS

Foreword by
Robert H. Cannon Jr.

Into Stability: Walter R. Evans and the Story of Root Locus

By Gregory W. Evans

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DEDICATION

Dedicated to the Memories

of the Men and Women

Who Helped Defend

the Free World

During the

Cold War

Advance Praise for *Into Stability*

Richard Murray

Professor of Control and Dynamical Systems at Caltech

"Greg Evans tells the fascinating story of his father, Walter Evans, whose development of the root locus method transformed control engineering. From foundational ideas to the clever "spirule" tool, this book captures the blend of insight and ingenuity that shaped the field. An engaging read for anyone interested in the history of engineering innovation."

Shalom Ruben

Teaching Professor of Mechanical Engineering at University of Colorado at Boulder

"The son of Walter Evans weaves a compelling history of a 1948 transformation in control engineering that remains a cornerstone of engineering education and practice today. This is a story of how family, teachers, and colleagues created an environment that nurtured the critical thinking and resilience needed to bring such an out-of-the-box idea to the world."

Qimin Yang

Professor of Engineering at Harvey Mudd College

"This book provides an intimate memory of Evans' life and his invention, his deep connections to people in academia and industry, and the critical impact of his work in the postwar aerospace industry and the training of the control engineers. I highly recommend this inspiring story to engineering students, particularly those interested in control theory."

John Doyle

Professor of Control and Dynamical Systems at Caltech

"This is a wonderful book about a giant of classical control who inspired me as an undergrad at MIT. I devoted my early career to bringing back the rigor and relevance that Evans and his contemporaries embodied and was sadly missing in modern control. Reading this book reminds me of what I missed in knowing the methods but not the man."

Don Evans

Former U.S. Secretary of Commerce

"Fueled by a passion for lifelong learning, teaching, and love of country, Uncle Walter was a humble and brilliant soul and one of America's most impactful engineers. After a debilitating stroke at 60, with the love and support of Aunt Arline, he taught himself to paint left-handed, continuing to grow, create, and inspire with every stroke of the brush."

David A. Peters

McDonnell Douglas Professor of Engineering, Washington University in St. Louis

"This is the fascinating story of Walt Evans, the man who invented the Root Locus design tool—and changed the world. We would not have made it to the moon without this methodology, which is still common use today. This book is a must-read for anyone interested in the history of technology and in the human stories behind it."

A Brief Explanation of the Title, *Into Stability*

What does the title refer to? Engineers use the term servomechanism for a broad class of control systems. The word "servo" comes from the Latin for "slave," referring to a mechanism that faithfully follows a command.

One example is the complex machinery that enables the James Webb Space Telescope to point precisely at a distant galaxy when an astronomer enters its coordinates. The servomechanism works to reduce to zero the difference between the direction the astronomer has commanded and the direction the telescope's sensors report that it is actually pointing.

Real machines take time to respond to commands, however, and those delays can cause oscillations. Designers of servomechanisms want the amplitude of those oscillations to decrease with time. When they do, the system is said to be stable. If the oscillations grow instead, the system is unstable.

In 1948, Walter R. Evans gave engineers a new way to design for stability. For the first time they had a practical tool for moving a design from instability *into stability*—hence the title of this book. His root-locus method made system behavior visible, teachable, and predictable.

Into Stability tells the story of that breakthrough and the engineer behind it. Blending biography with engineering history, it is a story of clarity replacing confusion—and how a single idea, widely shared, helped accelerate technological progress in the second half of the twentieth century.

Acknowledgements

This book was inspired by my father's colleagues at North American Aviation (NAA), whose bonds of affection supported Dad throughout his engineering career. Their recollections of experiences they shared with him during his trans- formative ten year period from 1945 to 1954 form the beating heart of Into Stability.

I am especially indebted to Gordon Walter, Robert Cannon, Jeff Schmidt, DeWitt Lyon, and John Moore for their extensive written accounts. Norm Parker, former President of Autonetics, contributed photographs of Dad's coworkers.

This book was made possible by my mother's meticulous record-keeping—hundreds of letters, originals of those received and carbons of those sent, carefully preserved and organized. Having access to these documents made writing this book possible; managing the sheer volume of correspondence made it a challenge.

I wish to thank the five engineering professors who provided comments and wrote endorsements based upon draft manuscripts. I am accountable for any and all errors.

My sister, Nancy, who read and offered comments on every draft, deserves credit for the book's keeping in balance its two story lines: Walter Evans and Root Locus.

I am thankful for the patience of my wife, Carol, who endured my hours of research, my takeover of a spare bedroom, and my 24/7 sessions typing at the computer.

Those hours were not wasted. Even if no one ever reads what I've typed, I will always treasure the joy of reliving good times with Dad.

Walter R. Evans c. 1950

Foreword*

Two things came together in the late 1940s: The remarkable young people in the auto-navigator division of North American Aviation's Aerophysics Laboratory and one of its new leaders, Walter Evans. This team was solving very difficult engineering problems one after another, to produce, for the first time anywhere, precise navigation systems for very long-range, unmanned aircraft and for submarines that went exactly to the North Pole, among many firsts. These were very hard systems to achieve. [1]

Control systems had to remain stable under conditions and deliver precise performance at speeds and ranges never before attempted. Classical analysis tools—while mathematically sound—provided little intuitive guidance. And perhaps the biggest gap: While it was clear that poles and zeros controlled a system's behavior, there wasn't a reliable way to move them around on the complex plane. That made it hard to design for specific dynamics, especially when stability had to be rock-solid.

Walter Evans, better known to his colleagues as Walt, was a person of remarkable insight and a major leader in the understanding of automatic control and how to design excellent systems very well and very quickly. One of his field-leading contributions was the invention of the root-locus method for seeing instantly the natural dynamic behavior a linear system will have, seeing it directly in terms of the control parameters at the designer's disposal. The method presents—in seconds—a plot of the

* A superscripted index at the end of a paragraph references a source in the Bibliography with the same index.

system's stability, speed of response, and the damping quality of all of its natural motions. [2]

These were very smart young people. They saw at once the power of the Root-locus method, and it spread very quickly through their culture at North American Aviation. It was just very easy to learn and use and place at the center of discussion of every control system design. From there, the root-locus method spread quite swiftly throughout the international culture of automatic control. It is still typically part of the first design steps and of the dialog among designers and users. [1]

There are several reasons for that. 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 these roots versus the design parameter being chosen, one can see precisely which values give good behavior and which will not—which values will make the system unstable, for example. [3]

Before Evans's root-locus method, these natural-behavior design decisions were most often made by the astute but very indirect methods of Nyquist and Bode and Nichols, which inferred them from the system's response to sinusoidal inputs. Good design throughout the years since has used the two methods concurrently. But it is the root-locus that gives the first quick, direct insight. And it is the root-locus structure that supports advanced optimal control design methods in a very fundamental way. [4]

Formerly, Evans taught courses at Washington University in St. Louis and at UCLA and presented seminars that always surprised. His book, Control-System Dynamics, and his seminal papers recorded succinctly his brilliant conception of automatic control. But the really fortunate students were the colleagues working beside Evans and watching a

wonderful, creative, agile, and unfettered mind working with zest and very special wit, which was always brought directly to bear.

His goal-oriented mind always approached any problem from a way no one else had ever thought of and often the only way that would work. Every so often, he would make a giant leap. He solved a rocket engine control problem after only an hour's exposure to it. It took quite a while for others to assimilate what his mind had provided.

Working with Walt was enormously stimulating and full of surprises. [In] no period in my life did I learn real engineering more rapidly, or more deeply, or with more enjoyment. Walt shared his office with two of us, Bill Mullins and I. Bill was also a terrific engineer and that was a great office for a young, green, fresh-out-of-school guy to be in. [3]

It was in those days that Evans led the development and construction of the stable inertial platforms for the guidance systems for, among others, the Minuteman [intercontinental ballistic missile], and two submarines called Nautilus and the Skate, which used those systems to navigate without any external reference. [3]

Evans saw the new problems coming, and in problem after problem his agile mind made giant leaps over the details to the key to the good answer. A problem for us was that, in his beguiling modesty, he just naturally assumed everybody else's mind worked as fast as his. Bill Mullins and I would scratch our heads and after about an hour we'd figure out what it was he'd just told us in five minutes. [3]

Then, in 1980, tragedy struck. At age 60, Walter Evans suffered a massive stroke. With his indomitable will and Saint Arline's unstinting support, he continued to bring love and philosophic inspiration to us all, to paint beautifully, and to play chess well and swim often.

He was most appropriately awarded the Oldenburger Medal from the ASME in 1987, the Richard E. Bellman Control Heritage Award from the

American Automatic Control Conference (AACC) in 1988, and the Engineering Alumni Achievement Award from Washington University in St. Louis in 1990. And the highest distinction of all was the deep and warm respect of his colleagues: Walter Evans inspired us so much. And he gave us so much. [4]

Above all, Walt Evans was ever devoted to his four children, Randy, Greg, Nancy, and Gary, and to his wonderful wife, Arline, who has been his super-supportive and brilliant companion throughout his life and career. [3]

Robert H. Cannon, Jr. (1923–2017) was the Charles Lee Powell Professor of Aeronautics and Astronautics at Stanford University.

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On June 2,1980, a stroke destroyed 30 percent of the left hemisphere of Walter Evans's brain. He subsequently taught himself to draw with his left hand. His drawings of cardinals honor his hometown, St. Louis, and their baseball team, the Cardinals

Introduction

The history of control systems and servomechanism design is rooted in the essential human quest to automate and regulate processes. Long before the advent of modern control theory, engineers and inventors grappled with the fundamental challenge of achieving stability and precision in mechanical systems.

The origins of automatic control can be traced to ancient times. Early examples include the float valve used in ancient Greek and Roman aqueducts to regulate water flow. Centuries later, during the Islamic Golden Age, scholars like al-Jazari devised water clocks with feedback mechanisms. These rudimentary systems demonstrated basic principles of feedback control, though the concept itself had yet to be articulated.

The Industrial Revolution accelerated the development of mechanical control systems. James Watt's steam engine governor, invented in the late 18th century, is often cited as a pivotal innovation. The governor used centrifugal force to regulate engine speed, maintaining a balance between power and stability. However, as industries demanded more precise and responsive systems, engineers encountered increasingly complex stability challenges.

By the early 20th century, the emergence of electrical engineering introduced servomechanisms—automatic devices that use feedback to achieve desired motion or position—became central to military and industrial advancements. Systems for gun aiming, aircraft stabilization, and ship navigation required not only mechanical precision but also rapid, reliable control responses. Engineers began to adopt mathematical analysis to predict system behaviors, yet tools for visualizing and designing stable systems were still rudimentary.

In 1948, Walter R. Evans gave engineers a powerful new method to understand and design for system stability: the root-locus method. First sketched on a classroom blackboard in 1948, root locus transformed a field that had relied on formulas and intuition into one where stability and performance could be visualized directly. It became both a practical tool and a teaching language, making its way into textbooks, classrooms, and eventually the software that every engineer uses today. Blending biography and engineering history, the book follows Evans through a pivotal decade of invention and impact.

But *Into Stability* is about more than method. It is about the life and character of the man who created it. Walter Evans grew up in a family that prized education, studied under teachers who opened doors to new ways of thinking, and found in Arline Pillisch a partner whose steady support carried him through both triumphs and trials.

His career began in wartime laboratories at General Electric, moved into the booming aerospace industry at North American Aviation, and was shaped by friendships, mentors, and students. The invention of root locus did not happen in isolation—it grew out of these roots, was refined through feedback, and ultimately proved itself by bringing stability to both systems and lives. The arc of the book is as follows:

Part I: Roots The foundations of Walter Evans's thinking—family heritage, education, and the crucible of early career experiences, combined with the entrepreneurial environment of North American Aviation, shaped both the man and the method. An insight prompted by a student's question in a classroom transformed his understanding. As an analysis tool, root locus competed with well-established Nyquist Criteria and Bode Plots. As a synthesis method that could design in stability, it was the only game in town.

Part II: Feedback No innovation takes hold without conversation and correction. Between 1944 and 1954, Evans's ideas encountered the influence of colleagues, students, and competing textbook authors. He relished feedback from users. His unorthodox way of explaining his method in journal and book manuscripts would delay their publication for months as peer reviewers gave negative feedback. More successful authors were university professors who benefited from classroom feedback. The feedback he did receive was positive. The exceptions were the reviewers of his technical papers and book manuscripts.

Part III: Stability This section reflects on Evans as engineer and father, and on the steady rhythm of his life. It gathers reflections from colleagues, connecting the technical legacy to the personal qualities-humor, humility, integrity-that defined Walter Evans the engineer and father. It concludes with recollections from my perspective as his son. These stories bring forward the father who inspired by example.

Epilogue: Tested by a stroke that left him disabled but never defeated, with Arline at his side, he demonstrated resilience and a joy in living, setting an example for young and healthy and infirm alike.

Appendices: Supporting material, technical notes, firsthand accounts and background documentation for those who want to dig deeper into the details of the root-locus method and its developer, Walter Evans.

Seventy-five years after its first publication in AIEE Transactions, the Root-Locus Method remains one of the most widely taught and used tools in control system design. Whether manually plotted with a Spirule or drawn instantly by software, it carries forward the clarity and ingenuity of Walter Evans. *Into Stability* is the record of how it came to be and the life that made it possible.

Cardinal By Walter R. Evans, 1 January 1991, Portfolio #207, Vol. 1

PART I

ROOTS

Insist on understanding!

Do away with superficiality!

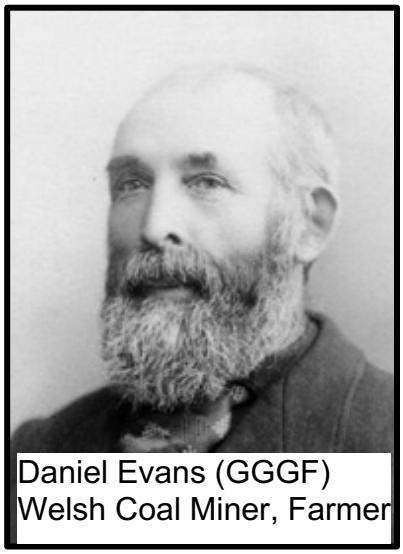
Stop memorizing words and formulas

that you don't understand,

merely for a grade.

Robert E. Doherty, Founder

General Electric Advanced Engineering Course



Daniel Evans (GGGF)
Welsh Coal Miner, Farmer

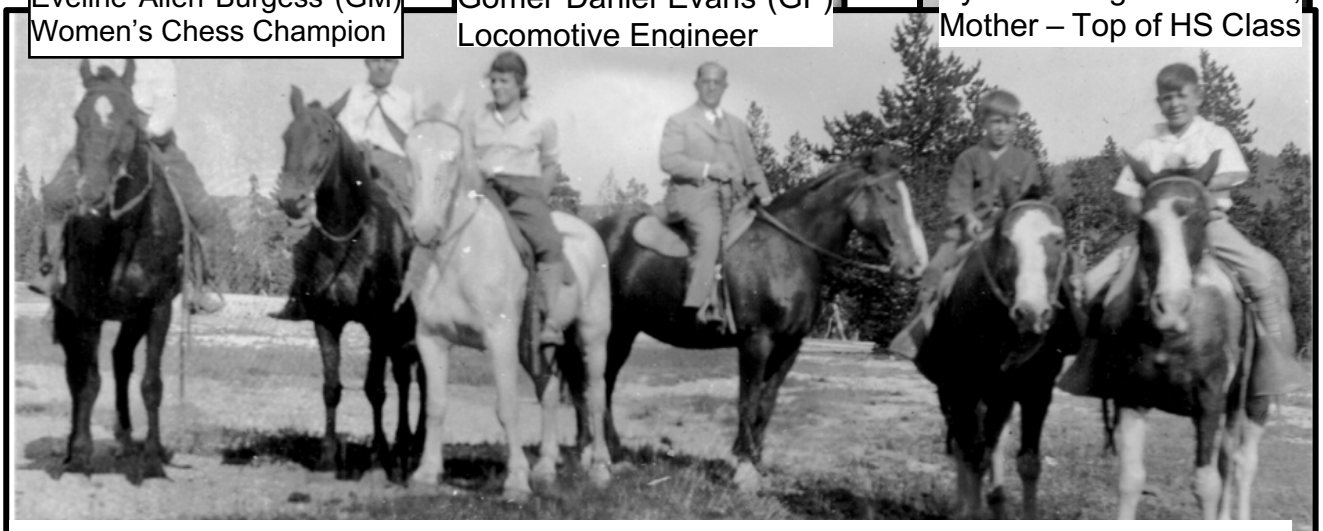
Samuel Burgess (GF)
West End Chess Club

James X Allen (GGGF)
Union Army Surgeon –
Washington Univ. Grad

Eveline Allen Burgess (GM)
Women's Chess Champion

Gomer Daniel Evans (GF)
Locomotive Engineer

Sybilia Burgess Evans,
Mother – Top of HS Class



On Farm Bought by Evans's 2nd-Great-Grandfather, Daniel Evans (1831-1917) in 1872

Chapter 1 St. Louis (1920–1941)

Walter Evans's journey to revolutionizing control systems engineering started in St. Louis, Missouri, a city that had shaped generations of thinkers, innovators, and engineers.

His roots, both familial and intellectual, were deeply embedded in this city's educational institutions, its intellectual circles, and its values. Walter's role models and the City of St. Louis were achievers.

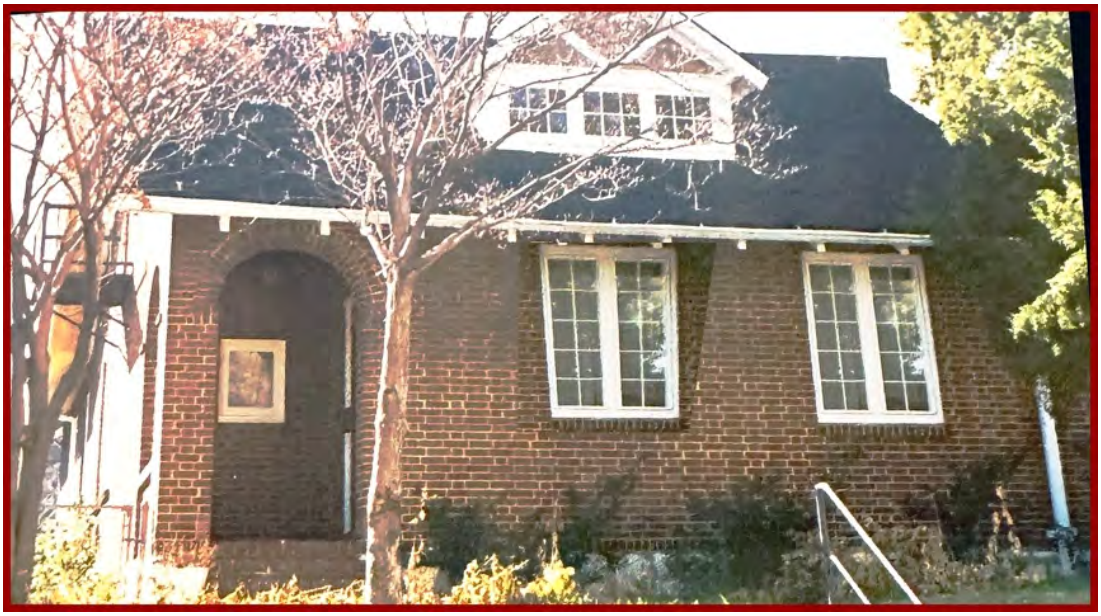
Cedric, Walter, Alice, Sybilia, and Sam Evans in St. Louis, c. 1928

A Family That Valued Knowledge

Walter Evans was the youngest of four children in a family that placed a high value on education. His maternal great-grandfather, James X. Allen, served as a surgeon in the Civil War. In the 1870s, James attended a medical college that later formed the foundation for Washington University's Medical School, a remarkable achievement for the time. Walter's maternal grandfather,

Both of his maternal grandparents were highly educated scholars and prominent St. Louis citizens. Samuel Rostron Burgess was a founder of the West End Chess Club, and his wife, Eveline Allen Burgess was the United States Women's Chess Champion in 1906. Walter's mother, Sybilia Burgess Evans was second in her high school class.

Walter's father, Gomer Louis Evans, and his two brothers, Joseph Cedric and Samuel Rostron Evans, graduated from Washington University with Engineering Management degrees, solidifying a family legacy steeped in analytical rigor and disciplined thought. Walter would follow in his brothers' and father's footsteps at Washington University.



Evans's Boyhood Home at 7048 Nashville Avenue in St. Louis

Walter's LDS Great-Grandparents

Walter's great-grandparents were all baptized in the UK into the Church of Jesus Christ of Latter-day Saints. All eight sailed from Liverpool, England, between 1842 and 1856 on sailing ships chartered by the church. His great-grandparents, grandparents, and parents met at church functions. Most of them then left the LDS church to join what they called the "Reorganization," later to be known as the RLDS church. Walter's parents participated socially but did not accept LDS theology. Three of their four children, including Walter, married outside the church and joined mainline Protestant denominations.

Walter's Welsh Ancestors: Daniel Evans and Gwenllian Williams Walter Evans's paternal great-grandfather, Daniel Evans, was a Welsh collier (i.e., a coal miner); he was one of four sons born on a farm near the South Wales village, Llandyfaelog, a few miles from the port city Llanelli. He left the farm to work in one of the massive coal fields in and around Merthyr Tydfil, where he married Gwenllian Williams in 1853. After they arrived in St. Louis in 1856, he worked in one of the city's numerous clay mines for sixteen years. [6] In 1872, Daniel Evans bought 65 acres about 70 miles southwest of St. Louis, near Sullivan, and became a farmer. His only son, Gomer Daniel Evans, was father to five children, including Walter's father, Gomer Louis Evans. The family owned the Evans family farm for more than a century.

Untimely Death: Daniel's Son, Gomer Daniel Evans

Gomer Daniel Evans became a railroad engineer. He was at the helm of a freight train in 1897 when the roadbed, weakened by storm waters, gave way along a stretch of the Missouri River a mile east of New Haven. All three crew members perished in the river. Gomer's older sons (Gomer Louis's brothers) abandoned their education and went to work to make up for the loss of income. Being the youngest, Gomer Louis was spared. He received a scholarship, earned an engineering administration degree, and became a Vice-President of Wagner Electric, a large manufacturing firm in St. Louis.

In 1917, Daniel Evans, the patriarch of the Evans family, died of pneumonia at age 85. The cousins hired Earl Burnett as its tenant farmer. They built a cabin to have a place to stay when family members, including Walter, went to the farm. They worked summers in the field, hunted rabbits, swam at the "swimming hole" on a tributary of the Merrimack River, and rode the farm's horses.

Farm Cabin near Sullivan, Missouri
The family built It as a place for them to stay

A Second Untimely Death

Gomer Louis Evans. Father

Tragically, Walter's father Gomer Louis Evans, vice president for Wagner Electric, died due to a surgical accident. At the time of his father's death, Walter was only 14 years old. Fortunately, Gomer had learned a lesson from the financial impact that the early death of his father had on his family. He had taken out a life insurance policy providing his wife a lifetime income. What sort of man was Walter's father? Perhaps H. N. Fifer's poem, *He Lived a Life*, recited at his memorial service on September 12, 1934, offers a window into his soul. [7]

was his creed?

I do not know his creed, I only know
That here below, he walked the common road
And lifted many a load, lightened the task,
Brightened the way for others toiling on a weary way;
This, his only need; I do not know his creed.

What was his creed? I never heard him speak
Of visions rapturous, of Alpine peak
Of doctrine, dogma, new or old;
But this I know, he was forever bold
To stand alone, to face the challenge of each day,
And live the truth, so far as he could see—
The truth that evermore makes free.

His creed? I care not what his creed;
Enough that never yielded he to greed,
But serve a brother in his daily need;
Plucked many a thorn and planted many a flower;
Glorified the service of each hour;
Had faith in God, himself, and fellow men;
Perhaps he never thought in terms of creed;
I only know he lived a life, indeed.

The Formative Years at Soldan High School

Walter's academic journey formally began at Soldan High School. It was here that he first encountered both intellectual stimulation and companionship. Geometry was his favorite subject, as evidenced in these comments he wrote to the author's high school trigonometry teacher: "Math has always been a game for me and now is a good part of my livelihood. … Geometry used to provide [me] a steady diet of looking for

a pattern that would lead to a solution before settling down to the detail of writing down all the steps."

Moreover, in geometry class Walter met Arline Pillisch, marking the beginning of a lifelong partnership. Arline was a brilliant student, becoming class valedictorian in 1937. The two young scholars set out on their respective paths, but their connection would endure. Her steadfast encouragement, patience, and belief in Walter's work were essential in his development. While Walter would go on to make significant contributions to engineering, Arline's role in his life was no less impactful—she was, in many ways, another root of root locus.

Two and half years after his father's death, Walter Evans graduated from Soldan High School. Its yearbook recorded that he served as senior class treasurer. Superintendent of Schools Henry G. Gerling made the following announcement on March 18.

> *The four year Honor Scholarship to Washington University allotted to each St. Louis Public High School was awarded to Arline Pillisch.*

Arline, whose GPA of 93.667 over four years put her at the head of her class, would be the first in her family to attend college. Upon learning of his daughter's opportunity to further her education in college, Reinhold Pillisch wept in joy. Walter and Arline would enter Washington University

Arline Pillisch
in St. Louis c. 1936

together in 1937, thereby giving their budding relationship an opportunity to grow.

Mentors at Washington University

Rich with intellectual rigor and pioneering engineers, Washington University was where Walter honed his analytical abilities, built critical relationships, and encountered mentors who would shape his thinking for decades.


AlexanderLangsdorf


Roy Glasgow


FrankBubb


Ross Middlemiss

Among those mentors were four professors: Alexander Langsdorf, Roy Glasgow, Frank Bubb, and Ross Middlemiss. These men were not just instructors; they were intellectual guides who introduced Walter to the nuances of engineering analysis, mathematical rigor, and practical problem-solving.

They instilled in him a disciplined approach to thinking—one that would later manifest in his groundbreaking work in control systems. Fortunately, copies of letters he wrote to his professors, decades after graduation, elucidate the impact these men had in his own words.

To Roy Glasgow, on the occasion of his retirement in 1966, Walter wrote,

Dear Dean

Walter Evans studying for a GE Advanced Course class, Schenectady, New York in the autumn 1941.

Glasgow. Fond memories provided by you are so numerous that I will have to limit this letter to those comments which triggered some key decisions in my life, or remarks that I have modified for various occasions. It is hard to believe now that, as a sophomore, I was planning on Engineering Administration. You advised that it would be better to prove myself as an engineer first and worry about the vice-presidency later.

The choice at graduation was between GE and Wagner Electric. You advised me of the glowing comments from alums of GE's Advanced Course but warned about the tough entrance exam. Fortunately, the exam was loaded with your kind of problem [which had] set the hook on my liking to attack any problem to achieve as much of a solution as

permitted by the initial conditions of knowledge and the time allowed to respond. The [1947 summer] job you set up at Emerson Electric set the stage for root-locus by requiring a real working-over of the complex plane in trying to get the frequency response cult off their j omega axis.

In a 1961 letter to Dean Langsdorf, Walter shared what he learned through observation of other students. Throughout his life, Walter had a keen interest in understanding how other people ticked. Here are his observations.

At Washington University I found that most students could memorize something like the vector diagram of a synchronous machine. If the subject was repeated about three times. A simpler situation which was not specifically discussed, however, would lose most of them.

A mid-semester quiz, in DC machinery … involved all dimensions of a motor being doubled. Several students said the test was "unfair" because we had not studied that. I personally learn most effectively by starting with simple examples and working up. Washington University was excellent in that professors such as yourself, Professor Glasgow, Dr. Bubb, or Dr. Middlemiss could and did take a student all the way back to the beginning if necessary and work up to the question at hand. I find that working with my children is a good testing ground for teaching methods because the subject matter is simple, the opportunities frequent, and the reaction clear.

Frank Bubb was known for his innovative thinking and ability to challenge conventional methodologies. He encouraged students to look beyond textbook solutions and explore new ways of approaching engineering problems.

Ross Middlemiss taught a rigorous engineering mathematics course from 1929 to 1969. Walter worked hard to earn As in his math classes.

The relationships that Walter forged with his professors went beyond the classroom. Their influence provided him with a foundation that he would later use to reshape the field of control engineering.

Although not a straight-A student, as Arline may have been, he earned As in the majority of his classes, even English and History. Somewhat surprisingly, his lowest grades, "gentleman's Cs" were in two mechanical engineering classes. [8]

John R. Moore: Mentor

John R. Moore, 1937, his Senior Photo at Washington University in St. Louis

Walter Evans in 1941, his Senior Photo at Washington University in St Louis

At Washington University, Walter met John R. "Johnny" Moore, an intellectual peer who would become one of the most influential figures in his early career.

Johnny would become an important collaborator and professional ally. Walter would follow him to Schenectady in 1941, St. Louis in 1946, and Southern California in 1948. That saga unfolds in later chapters.

The 1930s and 1940s were a period of profound growth in the fields of engineering and mathematics. Universities like Washington University played a pivotal role in fostering the next generation of innovators. Walter's time at Washington University coincided with a surge in research on servomechanisms, feedback control, and stability theory—topics that would later define his contributions.

Summary: The Roots of Root Locus

While root locus was still years away from being formalized, the foundational elements were all present in Walter's early life:

- Intellectual discipline, inherited from a family that prized education
- A network of mentors, who nurtured his engineering abilities
- A partnership with Arline, whose support provided stability
- The rigor of Washington University, which taught him to think
- John R. Moore, who would later influence his professional trajectory

Each of these elements was a root in its own right. Together, they nourished the intellectual ground from which root locus would eventually emerge.

By the time Walter Evans graduated in 1941, he had received more than an engineering diploma from Washington University. He was also a thinker shaped by a rich lineage of scholars, strategists, and innovators who possessed the skills, relationships, and intellectual curiosity necessary to make groundbreaking contributions to control systems engineering.

Walter's path was shaped by clear and distinct influences. His family, his mentors, his education, and his lifelong partnership with Arline were all essential elements of the equation. These were all roots of root locus—deep, interconnected, and essential to the innovation that would follow. As he embarked on the next stage of his journey, Walter carried these influences with him. His story would soon move beyond St. Louis, but its foundation would always remain rooted in the experiences, relationships, and institutions that had shaped his early years.

About this Paper:

This paper is derived from research presented in *Into Stability: Walter R. Evans and the Story of Root Locus* (Evans, 2025) and examines the historical development of the root-locus method within the engineering culture of the early Cold War.

About. the Author:

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