Oral History of Ronald (Ron) Rohrer

Interviewed by:
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Recorded: January 27, 2016
Henderson, Nevada

CHM Reference number: X7725.2016

Douglas Fairbairn: My name is Doug Fairbairn, and I'm here to interview Dr. Ronald Rohrer, who's a pioneer in Electronic Design Automation, as well as being involved in a number of other areas, as we'll learn throughout this Oral History. We are recording this at his home, or his former home in Henderson, Nevada. It is January 27th, 2016. So welcome, Ron! Happy to have you as-- and add your story to our collection of oral histories of pioneers in semiconductors and computing. So glad to have the opportunity to talk to you.

Ronald (Ron) Rohrer: Well, thank you for having me.

Fairbairn: So, as I was alluding to off-camera, we would like to go back and find out a little bit about where you were born, what kind of family life you grew up in, especially in the context of how it might have influenced your future direction and career in terms of parents or siblings or teachers or schools or whatever. So if you could just start there and talk about the early years of Ron Rohrer.

Rohrer: Okay, when I was born, my parents lived in Rio Vista, which is up the Sacramento River from the Bay Area. But my mother wanted to have a better address on my birth certificate, so they drove to Oakland. <laughter> So I was born in Oakland. And then my first memories are of living in Vallejo where my father was a welder and a riveter building submarines during World War II.

Fairbairn: Yeah, that was very heavily involved in shipbuilding in that area, wasn't it?

Rohrer: Yes. And then either at or towards the end of The War, when I was five, we moved to Clayton Valley, because he transferred to the naval ammunition depot in Port Chicago, where he was a diesel mechanic and ultimately rose up pretty high in the civilian ranks.

Fairbairn: So you were born in 1939, correct?

Rohrer: That's correct.

Fairbairn: Okay. Now you moved to Port Chicago. Wasn't there a very famous explosion that took place there?

Rohrer: There were two. But we lived in Clayton Valley and those explosions -- both were in either night or evening-- my dad was not on the job there, but there were for certain people he knew who were killed.

Fairbairn: These were explosions at the ammunition depot.

Rohrer: Yes, huge tragedies there.

Fairbairn: Right. So you were living in that area, but not actually present at the--

Rohrer: And really too young to understand the magnitude of that sort of thing. So basically, I grew up in Clayton Valley, or Concord, if you will, which was a pretty small town when we moved there. And went to Clayton Valley Elementary School with 40 kids per class. Pretty much country. Our neighbors had animals. And the one differentiator that I had was my dad was a Swiss immigrant with impeccable timing.

He came here in 1929, and then cut lawns and did what he could until he got jobs welding and riveting on both the Bay Bridge and the Golden Gate Bridge.

Fairbairn: Oh! One of the ironworkers up there. Wow.

Rohrer: Yeah, but at one point he told me once that he saw too many people fall and he just left that job. But so he was doing that sort of thing in Rio Vista when I was born. And then, as I said, he made his career working in civil service first building ships, and then managing. So that was in my background.

Fairbairn: So what about siblings?

Rohrer: No siblings.

Fairbairn: No siblings.

Rohrer: No, no. It was Depression, and they felt that was one was enough to deal with.

Fairbairn: Yeah, absolutely.

Rohrer: So my dad was in a bowling league for the Port Chicago thing. So my first money-making job was as a pin-setter, before that was automated out of existence. And so I used to get a penny [got that wrong, should have said a dime; a penny a frame] a line for setting pins at night. And then the other differentiator in my neighborhood was it was always understood that by-god I was going to get an education. And most of the kids I grew up around did not have that motivator.

Fairbairn: From your parents. Your parents were clear that--

Rohrer: Even though neither of them had a college education, I was going to get one. So in grammar school, I was a real pain in the neck to all the teachers. And so to get even with me, they skipped me over the sixth grade. So I was then young, really immature, and it showed. And that persisted through high school where instead of take-- I took one year of French, and I couldn't stand it. So I took radio shop for four years. And the reason that I was interested in radio shop was I really loved music from early on. Classical music, jazz. And I couldn't make music. Every instrument I picked up, I failed at miserably. So I decided, well, the best thing I could do was to reproduce music. And so I got things like popular mechanics and with my lawn-mowing money, and whatever other money I could get, I built what was then called Hi-Fi. It was pre-stereo.

Fairbairn: Mm hm, yeah.

Rohrer: And I enjoyed building them, but I hated that I couldn't design them. That I had no knowledge of that. So when I went-- my goal in going to college was to learn how to design circuits-- which I never did, but that was my goal.

Fairbairn: So you actually had, you know, this built in interest, and it came from music was sort of the original driving force.

Rohrer: Yes, yeah, music was the motivator.

Fairbairn: So in high school were there any particular teachers who sort of were mentors or help steer you in--

Rohrer: Well, absolutely. And first and foremost in many of the math classes, they just had me teach them. So that was fine. But and I was very shy, and I hated getting up in front of the class, but nonetheless I did that. But in my senior year, a teacher came into town and he wasn't my teacher. He was teaching civics and economics, I think. And I had a different teacher. But this guy was much more sophisticated than any teacher in my high school. When I had gone to counselor and talked to her where I was going to go to college, she said to me, "You'd be lucky to go the local junior college." And this guy said, "No!" he said, "Look, I see- my friends introduced me to him, he said, "You have talent, you can go anywhere." And he mentored me. And a number of others. His name is name was Alan Gellerman, and he taught us how to do the essays. What they do routinely now, what you probably pay money for. How to interview, etcetera. And he encouraged me to apply to the best of schools, which I did.

Fairbairn: Now this other teacher who was discouraging, did she say that with any knowledge of you, or just sort of was a cranky--

Rohrer: Well, my grade point wasn't the greatest, because I've always as a student, if I didn't resonate with the teacher, I got a C. If I resonated, I got an A. So I was not-- I didn't have a great grade point, but apparently I did okay on what's now called the SATs. I don't even think they had that name then. And so I applied to-- I applied to Berkeley, you always would, it was 20 miles away. But this lack of having taken a foreign language would have made Berkeley a tough haul, because I would have had to take it there, where I knew it'd be even harder than in high school. Applied to Stanford, to Caltech, to MIT and, on a fluke, to Yale. And so when it came in, Caltech said, "We don't want you." "Stanford said you're on the waiting on the list." And MIT said, "We want you."

Fairbairn: Hm.

Rohrer: So I think I was precient, and I thought, "The place that wants me is probably the best place for me to go." So even though it was a haul across the country, I went to MIT. And that was a fabulous learning experience! I've been around a number of universities, and that was the research university that cared the most about its undergraduates that I've ever seen. It was terrific being an undergraduate there. I resonated with a number of courses, primarily Circuit Theory and the Electromagnetic Theory, and Control Theory. Always theory, theory, theory for me. And I once gave a speech where I said that I built a whole career on sophomore circuit theory. And that's only a slight exaggeration, because if you throw in a little electromagnetics and linear algebra from junior year, that's what I've done.

Fairbairn: Interesting. So and sort of stepping back, you were already teaching math back in high school or middle school days, right?

Rohrer: Well, on occasion. It's like if I came in with an alternative proof than the one that was in the answer book, then that was an interesting concept that they'd have me portray. And I did that sort of

thing, because somewhere, both of my parents, I think, were both intelligent, and more importantly, creative. And so I've always delighted in doing things a different way. And I've got to go back to MIT and say they encouraged that. Not just in me, in everyone, in that era. And it was really, really important to me to have gone to a place that didn't stifle creativity, but rather encouraged it. And I'm not saying I'm the most creative person in the world, but I think I have a track record that says I'm pretty creative.

Fairbairn: Yeah, absolutely. So what year did you enter MIT?

Rohrer: 1956. And I so missed California that I overloaded my way through and got through in three-and-a-half years, so that I could get back to California. Now then I was accepted by Stanford and Berkeley graduate school. And I really wanted to go Stanford. I'd always wanted to go to Stanford. But Stanford wouldn't take you mid-year.

Fairbairn: Oh, yes.

Rohrer: So I said, "Oh, I'll just go to Berkeley." I wasn't going to go take a job and then quit it six months later. I felt that was unethical. I said, "I'll just go to Berkeley, and I'll take some courses and cool my heels, and then I'll go to Stanford in the fall. I'll get a summer job," which I always had. I had a summer job every year that I went to college, two summers I worked for Varian Associates, building, helping to build klystron tubes. And that experience would help me get through MIT faster, because I had a good mentor there named Armand Staprans, who really taught me everything you needed to know about wave guides and transmission lines, etcetera. So they had a policy at MIT that you could take the final in a course. And if you passed it, you didn't have to take the course.

Fairbairn: Oh, wow!

Rohrer: And I took that final and that accelerated me through. So that was a nice experience. Anyway, I went to Berkeley and I was pretty much an electromagnetics guy. But I took a course in Network Synthesis there. And I really loved that. And I took Classical Mechanics over in the Physics Department, and I loved that. And I thought, "Yeah, well, I've got some momentum here, I might as well stick." And they gave me a really nice fellowship for people in electromagnetics. So I went to the professor who was the right professor for electromagnetics, it would have been John Whinnery, but by then he was Dean, so it was another guy, and I'm not going to name this guy for reasons that you'll see shortly. So I walked into his office, and you know, he was going to be my research advisor, and the first thing he said to me is, "Do you know how to run a lathe?" And I said, "Yeah, I know how to run a lathe." And he said, "Well, do you know how to run a milling machine?" And, "Yeah, I know how to run--," and I could just see him drooling with anticipation of having a slave building his stuff. And I thought, "That's--," and I've always felt that graduate or undergraduate student slave labor is not a good learning experience. You know, there might be some things that have to be done. You might have to mop up some lines of code, but you shouldn't be asked to do anything that isn't prepping your mind. So I left his office and went and found the most theoretical guy I could. I found Ernie Kuh, who was the Network Synthesis guy. And so he became my advisor. And I did pretty well in that stuff.

Fairbairn: Interesting. So before you go on, I'd like to just set a perspective. Did you have in mind as you entered the University that you were going to get a PhD? Did you think you were going in the industry. Did you look at the academic track? Tell me a little bit about--

Rohrer: Excellent question. Because I had worked at Varian Associates, after my sophomore year, and again after my junior year, I worked in R&D and I was nurtured in R&D and I loved R&D. So when I was graduating from MIT, I went out and interviewed the usual suspects. And I remember one of the interviews, but they all kind of were like this, they said, "Well, where, son, do you want to be?" And I said, "Well, I want to be in R&D." And they said, "Well, you have to have a master's degree to be in R&D." I said, "Well, okay, I'll get a master's degree!" So that's what motivated me. I interviewed again, "Where would you like to be?" "Well, I'd really like to be in R&D." "Well, you need a PhD to be in R&D." So, fine! I got a PhD. <laughter> You know, and then what happened was that Ernie Kuh was my advisor, and I did a master's thesis, of which I'm quite proud to this day-- but I wasn't-- somebody else took it up and made it into his PhD while I was off on one of my summer jobs. So when I came back, I had nothing. And I was really spinning my wheels. And Ernie went on sabbatical in 1962/'63, and Mac Van Valkenburg came as a visiting professor. And all the ideas that I thought were terrible ideas, when Mac came in he said, "What are you thinking?" And I said, "Well, I'm thinking this." And Mac said, "Great idea!" "And what else are you thinking?" And I said, "Well, I'm thinking this," and he again said, "Great idea!" To qualify for a PhD, you had to have three to five propositions that you put before a faculty committee. And every one of my five propositions, Mac said was a great idea. Well, it turned out that none of them were great ideas. Some were-- a couple of them were good ideas. But the difference in having this guy tell me that my ideas were great, was all I needed. I accelerated through-- did a pretty good thesis on Time Variable RC Circuits. But again, and I saw clearly that if you changed the capacitor it had a resistive effect, but because I was so theoretical, I didn't see the application to switch capacitor filters, which came many years later, even though I had worked on active RC filters. So I stupidly didn't put that together. But I got out, which is the most important thing.

Fairbairn: And looking at your resume, you did it in like a couple of years, right? I mean, you only a couple of years from masters to PhD.

Rohrer: Oh, yes, two years. But I was lucky. And I was too young to know better. And so it all worked out for me quite well. And I really got going when Mac took me to Illinois to be on the faculty and I started working with graduate students of my own.

Fairbairn: Okay, so let's talk about that. You got your PhD. Did you then go out and interview for industrial jobs, or how do you want-- now get on the academic track?

Rohrer: No, no. Well, here's a good story. I told you earlier I was immature and very frightened to speak in public. And when Mac was there, he was teaching the junior course in systems. And he came to me, and he said, "I have to travel, and you must teach my course." And I was just scared. Unbelievably scared. I said, "Mac, I just can't teach your course. I just can't do it. I can't teach. I'm afraid of crowds. You know, I'm afraid of public speaking." He said, "Well, there's no one else who can do it. Charlie Desoer can't do it that day," etcetera, et al. He went through all the faculty who could have done it. Who couldn't do it. "Okay." So I prepared like crazy to teach. I mean, I really prepared! Sixty students. And one would

have scared me, 60 just scared the hell out of me! And so I'm there teaching the course, and I'm ten minutes into it, and I look up and there's Mac in the back row. You know, and smiling at me. And you know, after he said, "You did great, Ron. You're really a natural. You've got to do this," etcetera. So I only interviewed for academic jobs when I got my PhD.

Fairbairn: So you ended up enjoying the course. I mean, not only he said you did well, but you enjoyed yourself during the process?

Rohrer: I didn't!

Fairbairn: You didn't!

Rohrer: It took me a couple of years of teaching to get comfortable with the concept of public speaking. And then I got too comfortable. I got too good at it, and you know, and it was easy. On the day that they evaluate you as an instructor, you tell a lot of jokes, and you get a good evaluation. It actually works out quite well. <laughter> So anyway, I interviewed, and I won't name names, but Illinois with Mac was the only school that said, "You can have your own research program. You don't have to go work in somebody else's bailiwick." And that was very appealing to me. So I went there. Had a couple of really, really good graduate students. And the other thing is, I told you about having wanted to design circuits. Either both as an undergraduate at MIT and as a graduate student at Berkeley, every time I tried to take a Circuit Design course, it just seemed like Greek to me. I could not understand what these guys were talking about. So upon graduating from Berkeley, I had this notion, because I'd taken a lot of Control Theory stuff, and a lot of Circuit Theory stuff, that I could replace designers with optimization. That was-- so I started out in 1963 on that research track. I did several other things, but that was really my driving force was to use optimization to design circuits. And so that was sort of a career that I--

Fairbairn: So then you had to really understand circuits.

Rohrer: Well, you know, I thought that I could do it all via circuit theory. And it turns out that it takes a little bit more than circuit theory to get there, particularly in analog circuit design. But you know, I was young and I was ambitious and I was successful as a theoretician, so I just thought I could do it! So I plowed forward with several papers, at least, in that arena. But I left Illinois after a year, because I couldn't stand the cold.

Fairbairn: I was about to say, you wanted to come back from MIT, and this sounded like a repeat in terms of the environment, anyway, so.

Rohrer: Well, Mac Van Valkenburg was terrific, and I loved being around him, etcetera. And his [crowd?] of people, but I just couldn’t stand it. But there was another guy working in the field, Dan Youla, who was super brilliant. And I knew that from his papers. And so I got an Air Force fellowship and went to work with him at Brooklyn Poly. And just as a post-doc. Just to be around him. And this guy was--

Fairbairn: Now, the weather wasn't going to improve going to Brooklyn Poly.

Rohrer: Oh, sure. Much better than Illinois. You know, at least you're on Long Island Sound, and etcetera. And so I bought a converted 1690s barn as a home there. And so what could I do? When the fellowship was over, I went to work at Stony Brook. And it was too early in Stony Brook's life. It just wasn't the place.

Fairbairn: Now were they into circuit-- I mean, electrical engineer, circuit theory, and--

Rohrer: They called it Systems-- Applied something. I forget what it was called, but it was sort of-- they had some good theoreticians there at the time. But it just didn't feel right for a lot of reasons. So I had several offers, and my friends from Berkeley, Charlie Desoer, Ernie Kuh, Don Pederson said, "Look it, Ron. It's now or never. If you don't come back to Berkeley pre-tenure, we can't hire you." So I said, "Well, Berkeley really is the best that I've seen out there, so I'll go back." And I did.

Fairbairn: And that was in what year?

Rohrer: 1966. And I spent two years as an Assistant Professor, and I got tenure in 1968. And I did a self-evaluation and I said, "You know," I said to myself-- I'm going to say it to you now, "This all started with you wanting to be a practical engineer designing circuits, and you haven't done it. You're a theoretician." So there was a thing there called the Ford Foundation Program in Engineering Practice, where they'd pay your way to and from industry. So I thought, well, a predecessor of mine had done that, and he had stayed in industry. I thought, "Well, this is a good chance to see how I feel about industry." So I had various places I could go that to me were replications of academia. And I'm not trying to deride them, Bell Labs was a wonderful place, and I could have gone there. But I just felt that that would have been the same as staying at Berkeley. So I went to Fairchild Semiconductor, which felt a little more dirty hands. But I sold myself to them on the basis that I could use optimization to im-- I didn't any longer say to "design circuits." But to "improve their circuit designs." And a guy there named Bob Seeds, he either bought that, or he bought me. Anyway, so I went there, and he had a fairly substantial, what they called in those days, CAD Group that had some really good performers in it. So I was going--

Fairbairn: This was which year now?

Rohrer: '68.

Fairbairn: '68, okay.

Rohrer: So I was going to help them use optimization to design circuits. What I didn't realize was there wasn't any circuit simulation program, at least that was acceptable to them. Because we were already on the slippery slope of accurate models. And they had a circuit simulation program that came with their 360 Computer, came from IBM, but it used piece-wise linear modeling, and they hated that! They wanted their models to be smooth. So I, incidentally, up to that point had never written a line of code. My grad students had always written the code. And I needed a circuit simulator. So I sat down with an example book by a guy named McCracken, and it just was loaded with examples, and each time I thought up what I wanted to do, I'd go find as close as I could an example to that, and then I coded up this circuit simulator, which worked. And the thing that it had, there was one back at Berkeley. My colleague Bill Howard, had written

a program called BIAS that DC BIAS-ing that nobody at that time had cracked the transient problem. So my contribution was I figured out a very simple-minded way to make the capacitor inductor equation into a static Thevenin Norton equivalent. And then you could just do a succession of essentially DC analyses to build the transient. So that was--

Fairbairn: Now where was SPICE in this world?

Rohrer: That comes later.

Fairbairn: Okay.

Rohrer: This is the precursor. And so here I had this program, and I only had a bipolar transistor, and it was mine, I was playing with it, and one of my colleagues had to run one of his designs through the mil spec temperature range, which minus 55 to plus 125 degrees Kelvin, or Celsius, pardon me. And I said, you know, I said, "I think I can do that in five minutes." He said, "Well, it's going to take me three weeks." So I did it in five minutes. And he took what I did, and three weeks later he came back and he said, "By god! You've got something here!" so that was my--

Fairbairn: <laughs> So he went off and did it in three weeks, <inaudible>, right?

Rohrer: Yeah, yeah! He did the ovens and then the freezers and all that stuff. So that was my first customer. And after that I got so many customers that I built a group at Fairchild that was just doing that. So now we come to 1969. So I've been at Fairchild for a year. Got this circuit simulator going.

Fairbairn: Now you had left Berkeley, you were fulltime at Fairchild on a--

Rohrer: But I was on a leave.

Fairbairn: Leave, right.

Rohrer: So I still had my faculty position.

Fairbairn: Yep.

Rohrer: So my former advisor, Ernie Kuh, becomes Department Head. And Ernie had scheduled to teach a sequence-- Berkeley had the quarter system then-- a bad mistake that they amended later. You don't want to have three final exams and three sessions of students bitching about their grades at you. Two is better. <laughter> But anyway, so there was a succession of three Network Synthesis courses to be taught. And Ernie was adamant that I come back and teach them. I said, "Ernie, I've got this fulltime job here at Fairchild; I can't do it." Ernie was a very tenacious guy. And he just kept at me and kept at me, so finally I went to my boss at Fairchild, and I said, "Look, they really need me back at Berkeley. What do you think?" He said, "Oh, yeah," he said, "Sure just commute up there two days a week and teach that--"

Fairbairn: So you were living on the Peninsula somewhere.

Rohrer: Yeah, I was living in Menlo Park, and I was working at Fairchild, which was in Palo Alto pretty near this.

Fairbairn: Yeah, close-by.

Rohrer: I was at the R&D facility and it was just up there near Page Mill Road. And so Network Synthesis. So one of the deals about teaching is I've always taken teaching very seriously. And the way I teach is I write my notes the night before I teach a class. Or the day before, because [it takes] several hours. And then I certainly take the notes with me, but I don't look at them. I just try to do it spontaneously, and I've gotten away with it most of the time. So well, that, so I had taken Network Synthesis from Ernie many years before, maybe 1960 or '61-- '61. So I, in the back of my mind, I knew the material, but I had never taught it. And I knew I didn't have time to teach it. So I just said, "I'm going to teach them what I can teach them." So I walked into the class, I said, "Look here, guys, this is going to be a class in Circuit Simulation, and it's going to be team project. You're all going to be involved in it. And you can team up any way you want. And I'm your consultant." Because that's what I knew I could do. <laughter> And one student just came to me and said, "Well, you can't do that! You can't do that! Because I won't be able to pass the qualifying exam," or prelim exam, whatever it was. And I said, "Well, that's all I can do." So that student left. The rest, it turns out, for some reason it was a lot of circuit design people. A lot of Don Pederson's students were in this class. And they were very happy with this idea of a project and this sort of thing. And I also said to them, because I knew that Don was pretty hard-assed about simulation at the time, I said, "Don Pederson is going to be the judge of what you produce. <laughter> And if he likes it, you all get A's. And if he doesn't like it, I'm going to give you an oral final." And I had given an oral final in the System Theory course that I had taught just before I left, and I had one of my grad students, who I won't name, assist me in giving the oral final. And there's a pecking order in grad school that you don't realize when you're a professor. He just came down so hard on those people that they thought it was an anal final, not an oral final. So these kids had heard about that experience.

Fairbairn: They didn't want no part of that, right?

Rohrer: Exactly. <laughter> So we started out, and it was-- we were on the quarter system. So the first quarter was DC Analysis. And I fed it to them, and we did some things that I hadn't done at Fairchild, but pretty much I essentially gave them Fairchild's IP, which with 20/20 hindsight was not a nice thing to do. But that was all I could do to survive. And they did a great job. So the next quarter, we did AC Analysis. And they did a great job. And then the next quarter we did Transient Analysis, and they did a great job. And they did a particularly great job, because there were a lot of talented students there, but one who stands out, Larry Nagel was a student in that class. And Larry just took total ownership of it. And he fell in love with it, and he became very proficient at it. And over the next summer, he rewrote everything that the students did, and added a few nuances of his own, and that was Larry's master's thesis.

Fairbairn: And what was the name of the first version of this--

Rohrer: Oh, god! What did we call it? Oh, yes! We called it CANCER. Larry made that up. Because there was a program out there from IBM that was called SPECTRE. And at the end of it was radiation analysis [Effects, actually] that the Air Force supported. And so, you know, we're Berkeley, we want to stick a

finger in the eye of everybody. So this was Simulation Program for Electronic Circuits, Excluding Radiation. <laughter> And Larry came up with that one. And 20/20 hindsight, it wasn't a great name.

Fairbairn: Right. But I wanted to get it on tape.

Rohrer: And you know, and we published that paper, etcetera. And then in 1971, I think it was. A startup company came to me, and said, "We really like this idea of circuit simulation. Why don't you come with us?" And they had a fabulous front-end. A really good GUI that came from Mike Dertouzos at MIT. But the GUI was pretty content-less. That wasn't Mike's mission. And so what this company wanted to do was put together Mike's GUI--

Fairbairn: Mike?

Rohrer: Dertouzos-- with my simulation capability. Well, it turned out his GUI had much more ambitions than we could have fulfilled. And the other thing is--

Fairbairn: What was the name of this company?

Rohrer: SofTech was the name of the company. It was in Waltham, Mass. And so I went there. And I quit my job at Berkeley, and--

Fairbairn: Oh, you left again to go--

Rohrer: Yeah, but this time it was an absolute resignation. And so I went there, and we built what we could. There were some very good people there. Particularly a guy by the name of George Rodriguez. And he just put his heart and soul in it. And they made me Marketing. And so I was the guy who was flying around, and trying to get the sales thing going. And it was just an abject failure. I think-- well, I know, we were ten years ahead of our time. And it took the nurturing of the program and the use of it at Berkeley, the renaming it something reasonable, SPICE, which was different. Different in some good ways, and different in some bad ways, than what I had originally done. And but it caught on eventually with the first money being made on it ten years after I failed, by the Haley Brothers with HSPICE. So one of the entrepreneurial things that I learned from this experience is you can be too late to market, and you can be too early to market. And by god, being too early to market is really, really devastating. Because I gave up on it. I absolutely, in the intervening years, I really gave up on circuit simulation, and went in several other directions.

Fairbairn: I wanted to pick up the discussion where we were before, you were just talking about your experience at SofTech and that didn't work out for you, in terms of what you were specifically focused on. So pick up the story there and how did that wind up, and what was your next challenge to take on?

Rohrer: Well, I wound up without a job, and I believe it was 1972. And fortunately a friend, Walter Engl [ph?] was at RWTH Aachen in Germany, got a hold of me, and he said, "Look, we've got this new thing happening. It's the Alexander von Humboldt Stiftung Fellowship, and it's really lucrative. And why don't you just come here and spend a year with me and you can do whatever you want to do!"

Fairbairn: Now at this point, you'd been off-- you'd spent at, both at Fairchild and here, you'd spent a year away from academia. Did you have a bias at this point in terms of, "Gee, I want to get back to academia, or I want to stay in--," or were you just looking for an interesting job?

Rohrer: I was looking for an interesting job, and I hadn't really thought about it a whole lot. If I had thought about it, I don't know which direction I would have gone, because I sort of have this love/hate thing about academia. I love teaching, I love doing research. I hate everything else about it. And particularly the expectation that you're going to go out and bring in buckets of money. That's-- I never enjoyed that. So anyway, Walter offered me-- he said, "I think I can get this for you." And he did. And it was incredibly lucrative, because it was tax-free in both countries, and U.S. devalued the dollar while I was there. <laughter>

Fairbairn: That's a varied and multiple interventions, right?

Rohrer: Yeah. And I went there with some really good ideas, and we just couldn’t bring them to fruition, unfortunately.

Fairbairn: So what were the ideas? What were, you know, what was the challenge that you were looking at at the time?

Rohrer: Wanted to do circuit simulation. Because I was kind of hooked on that. But wanted to do it matrix-free, because the two things that kill you in circuit simulation, one is model evaluation, and the other is matrix solution. Everybody will tell you, "Oh, well, we use sparse matrix techniques and this and that." Even a sparse matrix can get awfully large. And so I was just looking for ways around that. And I now know how to do that problem. But now we're, how many? Forty years later? <laughter> Forty-five years later. So I finally figured it out. But anyway, at the time I didn't. But I had a good time. Skied in Switzerland, and I hadn't skied before that.

Fairbairn: So that was a year doing research, and pursuing paths that you found interesting.

Rohrer: Correct. You know, very unfettered and with a nice supporting cast.

Fairbairn: Was there a key idea that came out of that that you could use subsequently?

Rohrer: No. No. <laughter> But anyway, these were kind of tough times-- oh, I should go back to Fairchild, if I might. Because I was fully intent on staying at Fairchild, after I left Berkeley. And it turned out in 1970 or something, there was a big cut in defense spending, and Fairchild had to lay off 20 percent of its people. And I said, "Well, I have this tenured position at Berkeley, let's give my slot to somebody else, and I'll just be a consultant." So that was what pushed me back into academia that time. So when the startup SofTech came around-- I know I'm backtracking, sorry about that.

Fairbairn: It's okay.

Rohrer: When this startup, SofTech came around and said, "Hey, you know, we like what you're doing, and we like to come at it this," that was very intriguing to me. So I think I've always had a lust for being in and around industry and startups. But I've always had a talent for being an academic.

Fairbairn: So you went to Germany, had fun. Pursued some interesting things that you found challenging. And then what was the next step?

Rohrer: Getting a job back in the U.S. Well, these were tough times then. They were tough times in academia and I could not get a job from Germany. And recognize that I had already done the core of what's now called SPICE, but what's now called SPICE wasn't a big hit that it became at that time. So I really didn't have super credentials. At least people apparently didn't think so.

Fairbairn: Since SPICE is such an important element in terms of the impact on the industry, your point about SPICE was that it was a excellent program, but it took a long time to adopt and spread in gaining acceptance, is that correct?

Rohrer: That's correct. And I give full credit to Don Pederson and his people at Berkeley for having nurtured it over all those years, and essentially virally putting it into the industry via students. I don't think there was or is any other way to bring a disruptive technology into the semiconductor arena, and I think that's a shame, because I think there ought to be other ways, but I don't think there are, and that's a good way, if I were to do it today, I would try to emulate that. Although I don't know if I have all those years left in me to do that. <laughter> So I need to go poison some younger people. <laughter>

Fairbairn: Contaminate them anyway, huh?

Rohrer: Yeah, yeah, yeah.

Fairbairn: All right, so you came back to the U.S. after your year in Germany.

Rohrer: Well, since I had done pretty well there monetarily, and I had learned to ski in Switzerland, I just looked around for a place to ski for a year, and I thought, "I'll just ski and look for a job from there." So I went all around the west and settled on Park City, Utah. And bought a miner's shack for next to nothing, and skied all day every day for a year while looking for a job. The job I got was at Carnegie Mellon.

Fairbairn: So you skied throughout the winter, and throughout the season in Park City?

Rohrer: Yeah!

Fairbairn: Interesting.

Rohrer: It's not a bad life.

Fairbairn: No! <laughs>

Rohrer: But ultimately, you get low on cash. So anyway, Angel Jordan at Carnegie Mellon came and he said, "Look, we're gonna-- we're really into Computer Aided Design, and we're going to do this

multidisciplinary thing in all the fields, Chemical Engineering is going to have a CAD person. We have Steve Fenves over here in Mechanical Engineering. He's a CAD person. We want you to be our Electronic CAD person," etcetera. And I think there were a few others. And I said, "Wow! That sounds really exciting! And I need the money!" <laughs> So I went to Carnegie Mellon, and this just didn't work. I mean, it just so didn't work, because we were all of us prima donnas. And you know, and by then I was beginning to have a reputation, because this thing, this circuit simulation thing was catching on, and my role in it was known at least among aficionados. But it didn't work, and Pittsburgh was still sooty and grimy. And so--

Fairbairn: So what year did you go to Carnegie Mellon?

Rohrer: That was, I'm going to say '75/'76? That's clear. Might have been '74/'75. It's on my resume, perhaps correctly stated. <laughs> You know how resumes are.

Fairbairn: We can fix it in later edits.

Rohrer: Yeah. <laughter> Exactly. But it was '74/'75, I'm suspecting. But anyway, so went back-- missed the ski life at Park City. So went back for another year. And--

Fairbairn: Oh, to Park City?

Rohrer: Yeah.

Fairbairn: Oh, because you stayed for a year at Carnegie Mellon and just decided that that wasn't--

Rohrer: It wasn't working for a variety of reasons. And so I went back to Park City and skied for another year. And then I really desperately needed a job. And my friend, Frank Barnes said, "Well, here, why don't you come to Boulder for a year?" And so I had been a tenured full professor at Carnegie Mellon, I was a visiting lecturer at Boulder, because the Dean said, "If it's not a professor anywhere else, he can't be a visiting professor here." And that's another story. <laughter> Anyway, and I taught some interesting stuff. I never got a research program going in the course of that year. And then my friend, Mick Myers, who was another protégé of Mac Van Valkenburg, was dean at-- Dean of Engineering-- at Maine in Orono, and he said, "Boy, we really need you here, Ron. Come here and be the Department Head." So I went there, and I lasted two years there. I was a complete impedance mismatch with the faculty. Just wasn't going to work. So then another friend, Carl Wellenbrock, who was Dean at SMU said, "Well, come here, Ron!" And I really carefully interviewed there. And because Industry Committee really loved me, but the faculty really hated me. <laughter> So it was just another bad year. But the good thing that happened at SMU is this student from Switzerland, Aart de Geus, he came in to see me, he was matriculating as a grad student, and he had a book on CMOS Design under his arm, written guys named Carr and Mize, and he wanted to study with Carr and Mize. Well, Carr and Mize, had been maybe ten years prior, adjunct professors-- they were guys at TI, they weren't on my faculty at all. I started talking to this guy. I said, "Wow, this guy's really smart! He's really interesting!" I said, "You don't want to study CMOS design. You want to be an EDA guy. You're my student," that was Aart de Geus. So that's how I got him. And everything that I tried to do with Aart worked.

Fairbairn: So Aart de Geus later went on to found Synopsys and become a leader in the EDA industry as CEO.

Rohrer: Yeah.

Fairbairn: So he actually came in thinking he was going to study CMOS design, or study like IC design.

Rohrer: Yeah, he was propelled, perhaps even funded, by the Swiss watch industry.

Fairbairn: Okay.

Rohrer: Wanted to go more electronic and less mechanical. So.

Fairbairn: Right. And so how long was he your student?

Rohrer: Well, I only lasted there a year, so he didn't finish as precisely my student in terms of who signed his thesis. But I think it was maybe a couple of years before he completed his dissertation. He came and lived with me in Virginia when we--

Fairbairn: So did he begin-- I mean, did he begin that dissertation in pursuing logic optimization, or whatever?

Rohrer: No. No, not at all. This was-- it was another wacky idea. Actually it turned out to be a pretty good idea in circuit simulation that was picked up by one of my subsequent students and really made into something. Because this was a good idea. In the course-- so I had left SMU and went to Colorado, Colorado Springs to ski again. And that was another impedance mismatch. I was actually fired there by the Dean, because we were in a knock-down-drag-out fight over who of two people would get tenure. All things in academia come down to this stupid thing, tenure. Which, as far as I'm concerned, there are people who don't need it, and people who shouldn't have it. And that's the entire population. But anyway, we had a fight over that, and I got fired. And so some local people in industry there said, in particular, Gordon Hoffman and Dan Schweikert said, "Why don't you come with us?" They had something called United Technologies Microelectronics.

Fairbairn: Yes, I remember those people, and the company.

Rohrer: And I was very friendly with them. And I was just about to do that when one of my former students, Paul Russo, who was working for GE in Charlottesville and had this mandate to own the factory floor, said, "Come here, Ron, I'm putting together a team of interdisciplinary people who can--," and he said, "I don't know how you'll contribute, but you'll contribute." And I thought, "Well, this sounds pretty exciting. Something I haven't done." And I honestly didn't think that United Technologies Microelectronic Center was going to make it. So I went to Charlottesville and went to work for GE. And very quickly, it became clear that I wasn't going to contribute anything on the factory floor, but I knew a lot about EDA. So I got moved to North Carolina, which was supposed to be the epicenter of EDA.

Fairbairn: Now, you're doing a lot of moving here.

Rohrer: Yeah.

Fairbairn: Were you single at the time? Or--

Rohrer: I was, yeah, single, but semi-attached.

Fairbairn: Okay.

Rohrer: But yeah, I've done a lot of moving. Too much, perhaps.

Fairbairn: All very different parts of the country you've been.

Rohrer: Which, you know, I'm happy to have lived in different parts of the country. I'm happy to have been involved with different levels of institutions. I'm happy that I spent time in industry. A lot of time in industry. I'm happy that I spent a lot of time in academia. I'm happy for the years that I was associated with venture capital. I mean, these things just add dimensions to your thinking. And I like to think.

Fairbairn: Yeah, it's a tremendous background. Okay, so you went back to GE. You couldn't solve the factory floor problem, but maybe you could contribute--

Rohrer: So my mandate was to try to cause all the different EDA-- it was still called CAD-- but all that stuff that was happening in every unit of GE to be coordinated. Because if we could coordinate it, then they'd feed each other, and we could save money, and all the usual stuff. Herding cats; an impossible job. But I was in an airplane all the time, going to Schenectady, Syracuse, out to the West Coast to Calma, and Intersil [that's the original, there's a newer company named that, if it still exists, that does something else; the original Intersil was focused on analog integrated circuit design]. And it was clear to Mark Barron, who I reported to that I was just being worn thin. He said, "You need an assistant. Go out and hire the best person in the world." That was kind of the way they talked in those days of GE. We were in Jack Welch-dom. And I said, "Well, the best person in the world is my graduate student," who still hadn't completed his thesis, who was back at SMU, Art de Geus. "Your graduate student with no experience in the world? We don't believe it."

Fairbairn: Mm hm.

Rohrer: Well, flew Aart to Virginia. We got him in a suit. <laughter> Flew him up to Fairfield, GE Headquarters. The big guns interviewed him. And they called me and they said, "You're right. He's the best person in the world." So we hired Aart. And so then it was Aart and me flying around in the airplane.

Fairbairn: Interesting. In the GE airplane?

Rohrer: Oh, yeah, as often as possible. And but we had a small plane. If it was the West Coast, we had to fly in the commercial, but for Schenectady, Syracuse-- always these hard to get to places, yes, you wanted to use the GE airplane. Cincinnati, we went there. And god, I can't remember all the places. <laughter> But a lot of that sort of thing. But we had a group in Syracuse in the Electronics Labs. And this group had the inventor of the binary decision diagram, Shelly Akers. And they were contending that they

could use BDDs to affect a test of ICs, digital ICs. And I looked at this, and this was just pretty-- a research group, really, a development group. And I said, "Well, if you can find a fault on the BDD, we need to be able to map it to the fault on the chip. It's not enough to say, "Here's this BDD error," if we don't know what really went wrong over there."

Fairbairn: Yes.

Rohrer: And they couldn't. And I said, "Look," you know, we were on a cost-cutting mission, too. I said, "I'll give you three weeks, and if I come back in three weeks and you can't do that, I'm going to shut down this operation." Which was a lot of people. Aart and I flew up there three weeks later, and they couldn't do it. And we shut it down. And on the GE plane on our way back, I said to Aart, I said, "You know, if you were to realize a BDD with multiplexer logic, you could-- it'd map. It'd work." And kind of sketch that on an envelope. And he agreed. And I said, "Let's run with this." And the other thing that was happening, was-- now, look, we're not dumb enough to think that only multiplexers, we know you've got to refresh those every so often with something, but we had a little set [of transistors] that would have done that job. We were, our facility in North Carolina, and our other facility out in California, were only able to handle one level of metal. And we had competitors that were doing two levels of metal. So we were kind of behind in this thing, and we were doing wiring on poly, and wiring on poly even then at about 1.25 microns was not a good idea. It was causing failures because of the things running too slow. So we, boy, we thought, "The world's our oyster. This BDD, this multiplexer logic array, let's run with that!" Well, so Aart starts running with that, and he goes to our digital circuit designers, and they just hate the idea. "It's not the way we do things." This is the story I've heard through my whole life when you try to come with something different. "It's not the way we do things." I think to this day it was a good idea. But Aart being the smart and adaptable guy that he is said, "Well, I'll take what we're doing here, and I'll adapt it to what's real." And so he, with a team of really summer interns wrote the Socrates program, which was the synthesis tool that ultimately evolved into him starting Synopsys.

Fairbairn: So there was synthesis, or related technology going-- development going on at IBM and potentially elsewhere, maybe Berkeley or whatever. Is that right? And was there any cross-fertilization between what you were doing or--

Rohrer: I think we were pretty ignorant of that, but there was another Bell Labs spin-out, the name of which I can't remember that was doing bit-wize synthesis. And yes, definitely at IBM. And there was a company that spun out of Carnegie Mellon, Trimeter that was doing synthesis. So yeah, it was out there. Nothing informed us. And I probably shouldn't admit this in public, but that's typically how I work is I prefer not to know what's going out there, because I think it clouds things and prejudices you. And just go wild! And think the wildest thought that you can, and then take it from wild to reasonably practical. And then at that point look up and see if somebody else has done it, or if there's some competition out there.

Fairbairn: Interesting, okay. So Aart went off and did this. You were meanwhile continuing on--

Rohrer: I had gone to Calma.

Fairbairn: Okay, so let's talk about that. So you said, "Aart, why don't you go pursue this?" He got some interns and himself and they worked out-- were you consulting with them to kind of--

Rohrer: No, it was Aart's thing. It was entirely Aart's thing. Once I went to Calma, I had that set of problems.

Fairbairn: Okay, so let's talk about Calma. Tell us briefly what Calma was at the time, and why you were sent there. Tell me the whole story there. Because Calma is another major player in the early days of Computer Aided Design, and it's important to understand what happened.

Rohrer: Well, GE had bought Calma, and GE didn't like where Calma was going. And they had sent people in there before me, who had failed at sort of this mid-level management position, not even a Senior VP position. So think two layers below the CEO, and the thought was maybe I could, because they had sent people in before who didn't really understand Electronic Design Automation at all. They thought, "Well, we'll send Ron in there. He understands EDA, and we won't put him into technology. We'll put him in marketing. Because marketing drives the ship." That was sort of the thinking. Well, marketing drives the ship perhaps if you know anything about marketing, which I did not.

Fairbairn: So let's just step back just a moment. Do you remember when GE bought Calma?

Rohrer: I think they bought it about two years prior to when I--

Fairbairn: Which would have been--?

Rohrer: I'd say shortly after Casey [Jones] joined in 1980 or 1981.

Fairbairn: So '81 timeframe is when they would have bought it.

Rohrer: Yeah, '81, yeah.

Fairbairn: And GE bought it because?

Rohrer: Well, I don't know that I want to say the because. <laughter> Basically it was GE wanting to have more of a presence in the electronic technology arena. Thinking they had to do that.

Fairbairn: Okay. And so things were not going the way they wanted, and they sent you out there. What did you find? What was going on at Calma, and what was the competitive landscape that you observed from the marketing position at that point?

Rohrer: Well, the mindset at Calma, and I think a lot of this I figured out later when I became more sophisticated about these sorts of things. So let's say that I was pretty naïve and got pretty hammered by that experience. But basically the mindset at Calma was, "We're a computer graphics company." And so there was very little thought put to the applications. They were secondary.

Fairbairn: So they wanted to draw pretty pictures, but what those pictures represented or did or whatever was secondary thought.

Rohrer: And they were running on Data General hardware, and they wanted to really be their own hardware company, so they had a lot of that in mind. They also had a vision that they'd be a networking company. So a lot of R&D was pretty out there, "R, Big R," not "little r," "Big R." And but over in sales and marketing, it was, "How much hardware can we push?" And that was in every marketing meeting I was in was, "Can we get this customer to buy another disc drive kind of thing." And so there was little appreciation for the application, and that-- as I watched, particular, Daisy, Mentor, and Valid to come on the scene, coming on the frontend, Calma was focused entirely on layout, and I could never get them to think about the frontend. I even, Aart was still at GE, and I even said, "Hey, why don't you take up this synthesis thing? This would be a good direction to go." And the Calma guys said, <growling sounds>, "That's just crap! Who would want to do *that*?" You know, typical kind of a thing. So I just saw the handwriting on the wall there, and--

Fairbairn: So did you move out to California to run Calma, or to not to-- but to be in marketing in Calma.

Rohrer: I moved out to California to be as close as I could to Casey Jones.

Fairbairn: Okay. <laughs>

Rohrer: It's that simple.

Fairbairn: So Casey Jones is your current wife.

Rohrer: Yes.

Fairbairn: Who you met as a result of-- she was working at Calma, and the two of you met at that time.

Rohrer: Correct.

Fairbairn: So that was a good reason to move out here and so how long were you then employed at Calma? Did you ever go back to the main part of GE?

Rohrer: Never went back to the main part of GE. And I don't know how long-- again, the resume probably says, but it was not terribly long at--

Fairbairn: Say a year-plus?

Rohrer: Yeah, I'd say a year.

Fairbairn: And so you were working in marketing and sales kinds of activities. Besides that was not what your strength was.

Rohrer: That wasn't my strength, and also the original Calma guys who at least had an inkling of what it was we were doing, they were replaced by GE guys. And now it was GE guys, top two down to my level. And they were clueless. I don't know if we want this printed.

Fairbairn: Yeah, no that's fine. It's all right. We're not worried about GE reading your--

Rohrer: It was obvious that they were clueless. Calma went from several hundred million dollars a year to less than ten million dollars a year within the next couple of years. And yeah, it was passé to be focused on hardware in any design automation, if it was electrical or mechanical. That was certainly passé, but it didn't have to go away that quickly.

Fairbairn: Yeah, so 'cause Calma was a dominant supplier in the Computer Aided Design business during the 1970s for IC design. It was the standard hardware/software package.

Rohrer: Right, yes.

Fairbairn: Everybody used.

Rohrer: And it was expensive.

Fairbairn: And it was very expensive. Okay, so the writing was on the wall, this wasn't a good fit. Calma was not doing well. What was your next move?

Rohrer: No, they were still doing well, I just--

Fairbairn: Oh, at that point they were still okay, but headed in the wrong direction.

Rohrer: I thought so. And it was very difficult to work with the R&D guys there. They were pretty arrogant as computer scientists were in that era. And so that was-- I wasn't in-arrogant either, so that's a bad fit, to be sure. So Scientific Calculations came after me to be the CEO of their micro-- probably COO, who knows-- of the Microelectronics Division in Santa Cruz. And so that's--

Fairbairn: And the goal of that group was to develop design tools for IC design, correct?

Rohrer: For IC design top to bottom. Frontend, backend, everything. They weren't going to do polygon pushing. They were going to stop at the gate array kind of level or standard cell level. But--

Fairbairn: So they were going to try to compete with the Valid, Daisy, Mentor that had already gotten underway, and--

Rohrer: Yes, yes. But the guy named Steve Johnson who preceded me had a really fabulous much bigger vision. It was a great vision, but sometimes realizing great visions is utterly impossible. And I think this was one of those. And certainly we didn't have the budget and didn't have the attitude to fulfill his vision. We had a few customers who bought the vision, and then beat the crap out of me, because I wasn't realizing the vision.

Fairbairn: Okay. So what was the-- so how long were you at Scientific Calculations?

Rohrer: I'd say a year or two.

Fairbairn: Okay.

Rohrer: Seems to be my time constant.

Fairbairn: Yeah. <laughter>

Rohrer: So, as that as failing, we shut down that division in entirety. Carnegie Mellon--

Fairbairn: And that was-- I try to keep the--

Rohrer: Oh, the years?

Fairbairn: The chronology--

Rohrer: Well, that was probably '82 or '83. And Calma was maybe '81/'82, somewhere in that neighborhood. So I don't know. I guess I went looking for an academic job. I know I went looking for an academic job, because I had a few offers. But Carnegie Mellon, where I'd been, where the guy who had been Department Head had brought me in, Angel Jordan, was now Provost. And the Department Head was a former Berkeley student of mine, Steve Director, and they came to me, and they said, "You know, we could really use you here." And I said, "Oh, this just sounded--," Casey and I put it together, a matrix of all the places we could go and another one won, and we [both] said [simultaneously], "Well, that doesn't sound right. So let's go to Carnegie Mellon." We wanted to be--

Fairbairn: So now you were attached to someone, now you had to-- <laughs>

Rohrer: Yeah. And we felt that even though she had done really well, she was not credentialed. So we thought having her get an MBA would be a good move. "We'll stay there for two years. I'll think up a new startup. You'll get your MBA, and away we go!" Well, the first thing is Angel Jordan and Steve Director said to me, "Of course, Ron, we'll give you tenure, because we know you won't stay." <laughter> Anyway.

Fairbairn: You had established a reputation.

Rohrer: Yeah, for sure. But I think it's a good reputation, not a bad one. I mean, other people would say that it's bad. But I, as I said before, I don't like the concept. I've seen too many faculties destroyed by it in one way or another, including people who just get obsolete and are still hanging on, polluting undergraduates, and I don't like that idea at all. But anyway, so we went there. Casey got her MBA. I got some really good grad students, and everything was just clicking. So we stayed.

Fairbairn: So what was different then versus your first stint at-- was it totally different faculty and management there?

Rohrer: Yes, that was different. A guy named Dick Cyert who was the President-- what the hell do you call these people? The top of Carnegie Mellon was new to the job when I [first] was there, and he did a fabulous job of turning the school around, by essentially betting the endowment on really good people. He had an eye for talent, and he backed it to the hilt. So he backed the Computer Science Department, which was a pioneering department with Herb Simon and Allen Newell, just backed that to the hilt. Any place that he saw talent, he backed it. So it turned out that it was a very different environment when I

went back there. Because if Dick Cyert-- and it's a small place, nice family-- if Dick Cyert thought that you were talented, by god, you were gonna get plenty of latitude to evidence that.

Fairbairn: So what was the research direction that you pursued, once you were back there at Carnegie Mellon?

Rohrer: Well, I'd started off at circuit simulation. And so the first few people-- maybe the first one, that came out of there, Chandramouli Visweswariah [Chandu], who's now an IBM fellow, he took up the idea that I told you that Aart had done. And enhanced it and added some bells and whistles that made it practical. And that was his dissertation before he went to IBM Research.

Fairbairn: So you mentioned Aart. I just wanted to close the loop there. Did you have any further contact with Aart, or interaction?

Rohrer: Oh, I've always been in contact with Aart. We've always been friends. So yeah.

Fairbairn: I mean, did he seek your advice and try to figure out what to do with this new technology which had helped develop?

Rohrer: Oh, when he started Synopsys, I was an advisor to Synopsys. And I lasted until Richard Newton and Alberto Sangiovanni became advisors and then there just wasn't enough oxygen in the room. And I went to Aart, and I said, "Look it," I said, "I can't help you." And by then, he brought Harvey Jones onboard. And Harvey, the marketing genius that he was had recognized that getting a relation with standard cells was the way to fly, not to just be a pure synthesis thing. So it was beyond anything that I could help him with, and so I just bowed out.

Fairbairn: Okay.

Rohrer: But we've remained friends.

Fairbairn: Yeah, okay. So back to Carnegie Mellon. You were pursuing circuit simulation?

Rohrer: Yeah. Then a guy from TI came to me. God, I should remember his name. And he said, “Your simulator is killing us.” And I said, “What do you mean?” And he showed me a schematic of something they were simulating, and they had all of the interconnect modeled and a whole bunch of Rs and Cs. There were millions, maybe billions, of Rs and Cs, and they were actually feeding this humungous circuit into the simulator. And I looked at that and I said, “I just don’t think that you need to have all those Rs and Cs there.” I didn’t say it to him. I said it to myself. And then I just went off to a meeting of something called “CANDI,” and John Allen from MIT presented the work that a student of his, Steve McCormick, did on a little bit of that, based on something that-- I don’t remember who did it [Paul Penfield], but where you could reduce certain circuits in certain ways. So I went back to Carnegie Mellon, and I had a student who was Larry Pillage at the time. He’s Larry Peliggi now, and I said, “Let’s work on that.” And we worked on that, and we came up with a theoretical way to solve that problem, which, at the time, I didn’t even realize was tantamount to Pade approximation. We thought it [was] something we invented. We called it “AWE, Asymptotic Waveform Approximation;” no, “Asymptotic Waveform Evaluation,” because you never want to

say “approximation.” Anybody who’s using your tools, that’s a four-letter word. And I thought, well, maybe John Allen, and his student Steve McCormick, have already done this. So Larry and I, we flew to Boston and met with him, and we showed them our idea. And I said, “Look, if you guys have already done that, that’s fine. If you’re thinking along the same lines, let’s collaborate.” And to their credit, they said, “No. We’ve never thought of that. That’s really, really brilliant, and so we went back and developed, and this is the whole basis for all this model order reduction. I mean, it’s been improved upon, but that was the seed of model order reduction, which is standard now, and when you extract circuits and prior to fitting them to simulators, you reduce the interconnect, essentially its dominant poles.

Fairbairn: So the issue here was that in integrated circuits it wasn’t enough to model the interconnect as wires. They wanted to model the resistive and capacitive characteristics of it.

Rohrer: Because, I forget what the feature size was at that time, but the interconnect was becoming very important in timing analysis, in some cases really the most important piece, particularly in clock distribution.

Fairbairn: So being able to include those models in your simulation was essential to get the accuracy for your circuit simulation. And so, in this case, the fellow from TI had developed something much larger than you ever anticipated with SPICE.

Rohrer: Oh, confession. When I developed the simulator at Fairchild, and when I took essentially the ideas to Berkeley, FORTRAN, right, so you had to say how big your arrays were gonna be, I said, “I think that we can limit this to fifty transistors and two hundred nodes, and we’ll be good forever.” And, look, when I went to Fairchild, Gordon Moore was there, this integrated circuit with fourteen transistors. But, anyway, so that’s how little prescience I had on that axis.

Fairbairn: Right. So that turned out to be a wonderful idea, and you pursued that line of research for some time?

Rohrer: We pursued that line of research with several students, because we wanted to expand it in a variety of ways. We wanted to get it from lower frequencies up into RF [Radip Frequency], and so I had a student Eric Bracken] who did that, and we wanted to render it more efficient. The other thing was sometimes these poles would come out in the right half plane, so you wanted to do some research on how do I cause this thing to only produce left half plane poles. Then others were taking it up, and lots of people were taking up this research at MIT, at Bell Labs, at IBM, so it just became sort of another seed for a lot of that kind of stuff. That’s great.

Fairbairn: Did they pursue it at MIT, as well, you say?

Rohrer: Yes, MIT, Jacob White definitely pursued it, and Eric Bracken [?; I can’t come up with a name to match this??] had some very good ideas.

Fairbairn: Okay. So that’s another major.

Rohrer: So in the course of this, one of my colleagues, who had a company there, was beginning to pick up on this idea, and I had these four graduate students who weren't happy about our ideas being commercialized by somebody else, so they said, "Let's do a startup." And we negotiated it, and we came to this, okay, one of you will always be here getting-- finishing his PhD. Another three will be out there, and we'll just rotate this through. With 20/20 hindsight I don't think that was most ethical thing I could have done, but I was younger and naiver, and I did that. So they went out and they did this startup. Oh, they agreed to take a grad student salary to do it, which was fantastic. But they soon learned that they needed a CEO. They needed a manager, and they needed this other component, so without asking me they recruited my wife, Casey Jones, to run the company, to be the president of the company.

Fairbairn: They didn't think to ask you? Did Casey ask you?

Rohrer: Oh, of course, yeah, you know. She might have told me, not asked me. So she was running the Information Networking Institute at Carnegie Mellon at the time, the only non-PhD director of an institute, and doing a damn good job of it. But be she was a non-PhD, they weren't gonna pay her like they paid a PhD, so when these guys came and said, "Will you do this job for free," for equity, she said, "Sure." And that's when we came up with the idea that maybe one of us should have a real job and the other one should be at risk in a startup, because that second salary gets taxed at an awfully high rate. So anyway, so they did that. They got traction. This was a pre-extraction company. We could have raised money but it didn't come with the terms that these four students liked, and it turned out, I was on the board of Integrated Silicon Systems in Durham, North Carolina, in Research Triangle Park, and they'd just gone public, and people were calling them a one-trick pony. So one of the other board members said, "Well, why don't we buy this, your startup, and then we won't be a one-trick pony." So they bought our startup, not a very lucrative buy, but anyway that caused all of us to move to North Carolina, but one of the students just wouldn't leave Pittsburgh, so only three of the students went, and Casey and I went, Casey in a marketing position. I went because Casey went. I didn't have a job there.

Fairbairn: Right. But you left Carnegie Mellon?

Rohrer: I took a leave of absence that just turned into permanent because of subsequent events. I loved Carnegie Mellon, but I left. I'm a Professor Emeritus at Carnegie Mellon.

Fairbairn: So what was the name of this company?

Rohrer: Oh, the spinoff?

Fairbairn: Yeah.

Rohrer: Performance Signal Integrity, PSI.

Fairbairn: How did they get money?

Rohrer: Well, how did they get money? They got money with a second mortgage on our house, is how they got money.

Fairbairn: So you were the primary investor?

Rohrer: Okay. The other thing that Casey did was she went after every ounce of money that would come to a woman-run company, to a company with people who were paid below the poverty line, like grad students are, etc. So they got money that way, and they got some funding from some entrepreneurial thing in Pittsburgh, where they just had some money to grow things in Pittsburgh, so I think we got some of that, as well.

Fairbairn: So you were the primary investor in one way or another, and primary fundraiser through Casey, and so forth.

Rohrer: Yes.

Fairbairn: So how long would it remain independent before it was sold to ISS?

Rohrer: I think it was a couple of years. Casey could tell you better.

Fairbairn: Now did those students ever finish their PhD at Carnegie?

Rohrer: All but one. The one who didn't is a multiple successful entrepreneur. He loved the entrepreneurial experience. He was very good at it. He's still good at it.

Fairbairn: Right. There are many examples of failed PhD becoming successful entrepreneurs.

Rohrer: Oh, that's some serious-- yeah, yeah. So anyway, we moved to North Carolina. I was jobless. One of my fellow ISS board members said, "Why don't you come and be a venture partner here with our venture capital company?"

Fairbairn: With which firm?

Rohrer: This was Intersouth Partners, which is the premier, or was the premier venture capital firm in the southeast. They were really very good, and they taught me a lot, really, really. As the founding partner used to say about startups, "Three go north, three go south, and four are the living dead." You really want to hone it down and find out the characteristics of those three that go north. They do have some characteristics. Let me put it the other way. The seven that don't make it, they have some really stick out characteristics. And one of 'em, it's my checkoff box, if it's spinning out of a university, and there's a faculty member behind it, and he doesn't have the cojones to quit his tenured position and go with it, don't fund it.

Fairbairn: So how was that spinning out of Carnegie Mellon? Was that a common thing at that time? Was there a licensing issue?

Rohrer: Oh, yes. It wasn't common and, yes, there was a licensing issue. They were new to the game. Actually, Casey was the founder of their-- what did they call it?

Fairbairn: Technology Licensing Group?

Rohrer: Yeah. She did that for a while before she went off and did something else. They weren't enlightened at that time. MIT has always been enlightened. I think Stanford has been enlightened, at least back to when Fred Terman was the Dean.

Fairbairn: Fred Terman was an incredible visionary.

Rohrer: Wasn't he? Yes, yeah.

Fairbairn: And just a tremendous-- most people don't understand the impact that he had.

Rohrer: At one point in my career, when we were still purely academic, I received something called "The Terman Award," which was a very nice award. You had to look like you would be Fred Terman, which nobody in the world will ever be, But before you were thirty, you'd done this, etc., at a very young age. Fred was really a prodigy, and I had those characteristics, so it was pretty easy to get that award, 'cause not very many people had those characteristics. So when I went to the ceremony, Fred was still alive, and he presented the award, which was a very nice award, it included an actual pound of gold metal. Fred's heads and I'm tails, and a certificate, of course, and a check for, I think, a thousand dollars. Fred hands me this check, and here's what he said to me. He said, "Hewlett and Packard started on less than five hundred dollars. Now what the hell are you gonna do?"

Fairbairn: As I say five hundred dollars is the number I remember.

Rohrer: Yeah, yeah. So that planted a seed in my head that, oh, gee you know, there's another life out there.

Fairbairn: So bring me up to date here. What year did you leave Carnegie to go to North Carolina?

Rohrer: Nineteen ninety-four. And in the course of being in North Carolina, ISS was bought by Avanti. So then Casey became one of Gerry Hsu's marketing people. I know that sounds like an oxymoron. And I became his paid advisor, which is also an oxymoron.

Fairbairn: He doesn't listen to anybody?

Rohrer: Pretty much, but he's a smart, smart guy, and I learned a great deal from Gerry, so I don't begrudge that time at all. I mean, I know that stuff happens, but, you know, mistakes were made but not by me. And it helped. All these experiences helped, because now I've been involved with somewhere between fifteen and twenty startups, and I can only note one or two abject failures. That's pretty good.

Fairbairn: Beating those other odds you were talking about.

Rohrer: Beating 'em by a lot, and I think that all the diversity of experience, all the cynicism that you're hearing today, all that helps.

Fairbairn: Fascinating. So at this point, let's just take a perspective at this point. I mean, you had made a couple of major contributions, technical contributions, where you could say that you really influenced the

course of history, if you will, a new day in terms of SPICE simulation, and this later optimization tool, and so forth. At that point, and maybe it's the same now, what were you proudest of, or did you feel like you had accomplished what you had set out in your career, you know. What was your feeling about, 'cause you had such a diversity of experience, and maybe that was the goal. Maybe that was what you appreciated most. Tell me a little bit about how you reflected, at that point in time, and maybe now it's different, but we'll finish the story later, of course.

Rohrer: Well, as an academic, I think that there's, like, four pretty major accomplishments, one is simulation; another is the industry standard noise analysis adjoint, noise analysis from the adjoint networks that Steve Director and I honed which was gonna be part of optimization, and probably is somewhere, maybe a whole different field. I saw it being used in financial engineering a few years ago. The audit trail is thin, but anyway, so simulation, noise. Launching Aart into synthesis, I think was another contribution.

Fairbairn: That's pretty important. Yeah.

Rohrer: And then this whole extraction thing that became the star RC product ultimately of Avanti and then Synopsys. So I think there's four, sort of there were the fundamental ideas, and I'm not good at going much beyond the fundamental ideas, but others took them up, and enhanced them, and implemented them, and I'm pleased, I don't know, with pride of something. I guess I have it, so pleased and proud of having done those things throughout a pretty long career. And I have a fifth in my back pocket that I'm not gonna tell you about, because I haven't figured out how to make it into money, anyway, those. But the other thing that I'm equally pleased about is all these startups. It's work. It's fun. It's incredibly satisfying. It's a wonderful way, and I think you know this, too, to find out the real character of people that you're around, because it brings out the best and the worst in everybody.

Fairbairn: Yeah, okay. So we're only part way done in terms of chronicling your contributions in your career. So ISS purchased this other company, and then ISS, itself, was purchased.

Rohrer: Yes.

Fairbairn: And you're in North Carolina. What's your next move, Ron?

Rohrer: Well, I'm turning sixty, and I don't have a job, and because of the disruption, let us call it, at Avanti, Casey doesn't have a job, because she wasn't at Gerry's side when the FBI raided the company.

Fairbairn: Right. So just to fill in a couple of holes here for the readers of this, Avanti was sued by Cadence for allegedly stealing code for routing technology. Correct?

Rohrer: I don't know whether it was routing technology. It was code for something.

Fairbairn: Code and there was FBI raids, and court cases.

Rohrer: And Gerry, like so many people like him, really prized loyalty, so if you weren't there in the foxhole with him, you weren't loyal. So now we're both without jobs. We're living in North Carolina.

We're both very fair skinned. Mosquitos love us, and there's plenty of 'em there. We had a place on a lake, but we couldn't go outside.

Fairbairn: Oh, dear.

Rohrer: And I'm turning sixty, and I said, "You know, I'd really just like to get back to California, so since we're jobless, let's move back to California." So that's what we did. We moved to Palm Springs, where she grew up. We did an incredible remodel of a house.

Fairbairn: So you weren't looking for a job. You were looking for a place to live at that point.

Rohrer: Correct. But I was still associated with Intersouth Partners, the venture capital firm, so I was still going to Silicon Valley to look at potential idea. But they correctly came to the conclusion that if something wasn't within easy striking distance, then they didn't want it, because when these things start to go south, it takes a lot of time and energy, and you don't want that being spent on airplane rides, etc. So Intersouth and I parted ways. I had actually invested in a couple of companies for them. One was Neolinear in Pittsburgh, where I was chairman of the board, and one was Comstock Systems in Silicon Valley.

Fairbairn: Those are yet to come.

Rohrer: Yeah. I guess they are yet to come.

Fairbairn: That's a common characteristic that I discovered also in the venture world is that if they couldn't get home and back in a day, then it was gonna be too much effort, too much time traveling, and so forth.

Rohrer: Yeah. Another of my students in Silicon Valley was doing startups. Charlie Huang was doing CadMOS, so he brought me on as an advisor. So I just got more and more kind of drawn into Silicon Valley, and after a couple of years of too much commuting, we just decided we'd move there.

Fairbairn: So you left. You're in Palm Springs. You remodeled a house, and then decided, well, time to move on.

Rohrer: Well, that was the source of my income and gratification. Once we move to Silicon Valley, Casey got reinvolved with a few startups.

Fairbairn: So when did you move back to Silicon Valley that time?

Rohrer: I could tell you exactly when it was, 9/11 2001.

Fairbairn: Oh. We both know exactly where we were.

Rohrer: Yeah, exactly, exactly. Casey was in Palm Springs and I was taking our son, Max, to school.

Fairbairn: Okay. So you moved back to Silicon Valley. What things did you get involved in there?

Rohrer: Well, what I told you, but I was primarily involved with Neolinear in Pittsburgh.

Fairbairn: Which is a company you helped start?

Rohrer: I didn't. It was started by two Carnegie Mellon colleagues. Yeah. But at one point I was at a meeting of ICCAD, and one of the founders said to me, "We're in trouble, Ron. Can you help us?" And I was in VC at the time. I said, "Well, let's look into it." So I looked into why they were in trouble and what could I do to help them, which was obviously to bring them money, but also to bring them a CEO, so I brought 'em Tom Beckley, who I'd been involved as a board member of another company that Tom was in, and I knew that he was a fabulous player. So I brought them those two components and Tom turned it around. And then we got a bunch of DARPA money in the RF space, which is where I started my career. So then I got more involved and really was working for the company in Tempe, because I brought another of my former students onboard, Aykut Dengi, who was an RF guy.

Fairbairn: So briefly describe the elevator pitch for Neolinear. What was it up to? What was the goal?

Rohrer: Automatic layout of your design. That was the first elevator pitch. The other was automatic sizing of your analog.

Fairbairn: So both layout and sizing, and so forth, were aimed at analog circuitry versus digital circuitry.

Rohrer: Correct. So they called themselves-- okay, the elevator pitch, The Analog Synthesis Company, is what they called themselves.

Fairbairn: And that company eventually what happened?

Rohrer: It got a few customers, and got a partnership with Calma [Cadence]ultimately got itself in a good bidding war, for a variety of reasons that I can't talk about, and got purchased by Calma [Cadence]. Part of the purchase agreement was that I would be a fulltime employee of Calma [Cadence]. It was sad. I don't know whether this was a bluff, that if I didn't take that the deal wouldn't happen.

Fairbairn: So coming back to Calma [Cadence] after many years.

Rohrer: Oh, Calma was part [actually Cadence; my mistake, they remind me of each other] of Cadence, Cadence, Cadence.

Fairbairn: Cadence, okay, yeah.

Fairbairn: So what year was Neolinear bought by Cadence then?

Rohrer: 2004.

Fairbairn: Okay. So that was after I left. Okay.

Rohrer: Yeah.

Fairbairn: Yeah?

Rohrer: This was a Jim Hogan engineered deal.

Fairbairn: Right. So you were there. You stayed at Cadence for a period of time, and then moved on from there.

Rohrer: Got fired. That's moving on.

Fairbairn: They decided to shut down that operation as a result of prioritization of resources, and that sort of thing. Right?

Rohrer: Yes. Interestingly enough, they made offers to all of my people but me after they did this. Yeah. What does a guy over sixty have to say about things like that? A lot.

Fairbairn: I know you've been involved on a number of boards and so forth, and some related to EDA, or electronics, or whatever, other's not. So give me a quick sort of, if I'm not missing something, sort of a quick summary of sort of how things have progressed, and what directions has life taken for you in terms of business activities, and the like?

Rohrer: Well, I'd say when we left Cadence, we tried to-- we thought that because of the Neolinear route, things were not being done right, and so we tried to replicate, at least the front end part of that done right in a startup, that was with my last PhD student at Carnegie Mellon, Aykut Dengi and I, and with Casey's and my money, and we've developed what I think is probably the best thing I've ever done, been involved with, but we're not business guys. That's crystal clear. I'm good at advising. I'm not good at doing, so we've shut that one down. After many years we shut it down about two years ago, and the ideas are still there. They need to come out. They need to come out, but they're still there, and Aykut is off pursuing other avenues. So that was one thing we did. Another thing is Casey and I wind up, for reasons that are our own, in Bend, Oregon, and our good friend, who you probably know, Gordon Hoffman.

Fairbairn: Who I've not spoken to for decades, I think. Yeah. He was a wonderful guy.

Rohrer: Same guy. He's running a venture fund that is chartered with only funding things that come out of the Oregon University system, which is a thankless task, in my opinion. But he came to us. He said, "I met these two entrepreneurs who live right where you live in Bend, and I think that they really have a compelling story. You should meet them." So these guys are experts in solubility, and their elevator pitch is that seventy percent of the drugs that are known to be efficacious and non-toxic have solubility issues.

Fairbairn: And this is important because.

Rohrer: If you can't get a bioavailable amount you may be able to get bioavailability via intravenous, but that's incredibly expensive. So what you want to do is try to formulate any drug you can as oral, and there's a lot of other conditions on oral formulation. You have to have time and temperature stability. They have to be small enough to swallow, or people won't take them twelve times a day. So anything

that you can do to render something more soluble is huge, we learned, and it's pretty obvious in the pharmaceutical industry. So these guys have that expertise. Oh, they also had a potential CEO, and I looked at his resume, and I said to them, "This guy's gonna tell you he has a big Rolodex and he wants fifteen percent of the company." They said, "How'd you know?" I said, "We've been around." So basically we made them a very sweet deal. They might not have known it, but I always like to be generous to my founders, because it can't hurt you. They can grow the pie big enough. So anyway, we gave 'em a good valuation and a good investment. It turned out they were so good that we were the only investors, and I ultimately became chairman of the board because of some dissension that always happens when you have these kind of things. And Casey then went in to do their positioning and marketing, which is her expertise; did a great job of that, [in] a whole, new field for her and for me, and we had a very nice exit.

Fairbairn: And that was purchased by a large drug company?

Rohrer: Yeah. It was purchased by a larger company, not a drug company like the ones you see on TV advertising, one of the companies that does the formulation. A lot of the drug companies are pretty much sales and marketing, and everything else is outsourced, so this is one of these outsourcing competitors.

Fairbairn: Okay. So you subsequently left Bend, Oregon, and came to here. You're in Nevada.

Rohrer: Yes.

Fairbairn: And you continue to have your fingers in a couple of things, or you've largely unwound your business activities at this point?

Rohrer: I don't have any more business activities. I still do research, because it's therapeutic.

Fairbairn: Do you collaborate with others, or is this just your own research?

Rohrer: I was collaborating with my student and friend, Aykut, but he needs to go out and make a living, and so lately I've just been doing it by myself, which isn't so good. I much prefer collaboration. Basically you can get a lot more done when you're bouncing ideas off of people, particularly if they're open minded people. We have this thing that we call "WAT," which is a wild-ass thought, and you start with that. You break all the rules and you say, "What if gravity didn't exist," or whatever. What's the idealization of this problem that I can solve? What's the closest idealization I can find? Let me go solve the idealization. Now let me ask how do I morph from that to the real problem, and how far away am I. What are the metrics? If I'm near it, I do one thing. If I'm far, I do something else, and you fail fast, iterate, and you get the problem solved, problem solved.

Fairbairn: So one of the people that was eager to have me do this interview was Curt Widdoes, who is on the Board of Trustees of the Computer History Museum, for whom we're doing this oral history. What is your relationship with Curt Widdoes, or is purely by reputation, or did you ever work together?

Rohrer: We have never worked together. I've met with him around a few things when he was back in startup land, and he and I, I think, work pretty much on the opposite side of the spectrum, so I think it's mutual admiration. I think when I see a smart and successful person, I think I can recognize that.

Fairbairn: Well, he was very eager to make sure this happened one way or another.

Rohrer: Well, I'm pleased. I haven't talked to him in a long, long time.

Fairbairn: Okay. So Ron, I appreciate the time you've spent. I wanted to wrap things up and make sure that we've gotten a good picture of your perspective. I stopped you before, in terms of asking you to take a look back. Now moving ahead in terms of that timeline, several years, you know, is there any other comment, or summary, in terms of where you had your most-- what was the most enjoyable part? Is there any one particular experience where everything came together and you thought it was, you know, this is sort of all good things happen at once? Or what would you rate as being the most productive or impactful aspect of your career?

Rohrer: When I received the Kaufman Award, in my acceptance speech I said, "I must be getting this because EDA thinks I've done something for it. EDA gave me Casey Jones. I got the best deal."

Fairbairn: Yeah. Oh, that's a wonderful thought. That's a wonderful thought.

Rohrer: So I'd say that mine has been a multifaceted and checkered career with a lot of ups, and downs, and experiences, and I wouldn't trade it for anything.

Fairbairn: Great summary. And you got a wonderful wife out of it, also.

Rohrer: Yeah, exactly.

Fairbairn: How could it be better than that?

Rohrer: Yeah.

Fairbairn: Okay, well, then, we'll wrap it up here, and thank you very much for the time you've put in. And it was certainly well worth my coming to sit with you and discuss it. I've enjoyed it immensely. Thank you.

Rohrer: Me, too. Thank you.

END OF INTERVIEW

