

**Q:** If we could start with your name and where and when you were born.

**Richard Klafter:** Richard Klafter, I don't know whether you want the middle name, but Richard Klafter. I was born in New York City. You want the date?

**Q:** If you're willing to provide it.

**Richard Klafter:** Oh sure. August 5<sup>th</sup>, 1936. A lot of my problems is that I'm old. I don't feel old, but anyway, yeah.

**Q:** Could you tell us a little bit about your early education?

**Richard Klafter:** I was educated in New York City, I went to public schools. My elementary school was PS Public School 117. My high school was Forest Hills High School, which is a really good school. And then I got my undergraduate degree at MIT, and I got two graduate degrees from Columbia, and I got my PhD from the City University of New York.

**Q:** What did you major in?

**Richard Klafter:** They were all electrical engineering with emphasis in my PhD, in automatic control.

**Q:** Who did you work with for your master's degrees, and what were your thesis?

**Richard Klafter:** Well, at Columbia there was no thesis. You just took courses, and I took 32 semester hours in one year. I look back I don't know how I did it, but I did it. And then I decided I always viewed myself as going into industry, and never imagined that I could have a career. And I decided well I didn't really want to go out and work, and Columbia offered, as a few other schools in the United States do, a degree between masters and PhD called, in this case, it's an engineering degrees, and in my case an electrical engineers degree. So, I got an EE degree, which was 30 more credits. And that point I was married, we had a child, and I had to make some money, so what I did was I started tutoring at Columbia. And I found I really enjoyed it. I really enjoyed teaching. And so I remember, it's like yesterday, I was so naïve, I decided, you know, I would like to try my hand at teaching at a university. So I marched myself, this is over the

summer, I marched myself up to City College that was part of the City University, and I walked in, and I said, "I want to teach." You just don't do those kinds of things, but I did.

**Richard Klafter:** It turned out one of their faculty members had had a heart attack that week, and it was close to the beginning of the semester, and they needed somebody, so they hired me. And I never really taught courses before, and I found I really enjoyed it, and I thought I was pretty good at it, students seemed to take to me. And 42 and a half years later, okay, I taught for a total of 42 and a half years, at three different universities, the City University of New York, Drexler University, and Temple University. I finished up at Temple University.

**Richard Klafter:** I did 17 at Drexler and 17 and a half at Temple. And for the most part I truly enjoyed teaching. I enjoyed it. I enjoyed interacting with students that was the fun part. And it's when the administrative part started to get in the way that it really started to sour me on it. Also the students changed. Students changed, I found, they were only interested in getting their degree and getting out. They weren't interested in learning, and that kind of hurt. And it came time to face the reality, and I said, "You know, I don't want to do this anymore." As a matter of fact, I can remember, I was teaching a class, it was my last class of the day, I came back to my office, and I sat behind my desk, and I said, "You know, I don't want to do this anymore." It was an epiphany. And I retired at the end of that semester, and I've never looked back. I enjoy what I do now, which is not scholarly, but I feel I'm making a difference. Do you want me to describe any of that?

**Q:** Sure.

**Richard Klafter:** I volunteer for a group called Recordings for the Blind and Dyslexic, except it's now called Learning Ally. They changed the name. And what we do, our group, is all over the country, they have studios all over the country, and in our group we read mostly textbooks. And I've had an opportunity to read some of the books I used in class. The problem is that there aren't too many engineers in our group, and they think anybody who's an engineer can do anything. Well it just isn't so. One of the problems is with engineering or technical books there are figures, and you have to describe the figures. You don't have a script, you do it ad hoc. And it can be really a problem when you don't have the language. And there are some things I just won't do. I won't do, for example, organic chemistry. I don't know organic chemistry, it's silly for me to try.

**Richard Klafter:** But I've been reading recently a book on materials engineering, and I don't have the language there. Some of it I feel like I'm hanging on by my fingernails, so. It's interesting. But I've interacted with some people who use the service, the students who use the service, and it makes a tremendous difference in their lives. These are

people, for the most part they're not blind, they're dyslexic, and they're able to excel because of this. What they do is they have the book in front of them, and when they listen to the text they can follow along, and it helps them learn. And I've read things that they've written, and it really impacts on them tremendously. So it's been great. I've enjoyed that.

**Q:** What was your research project for your PhD?

**Richard Klafter:** My research project was optimal control, and if you think I remember what the name of the thesis was I don't. But it was very mathematical, and I used functional analysis in this thing to analyze certain aspects of optimal control. I didn't like my thesis advisor. He was not a very nice person. Maybe I shouldn't say that, although he's probably dead now. But I learned how to write from him that's one thing I did. And whenever I wrote papers people always complimented me on the writing. So, I got that from him for sure.

**Richard Klafter:** But I remember one of the things that really turned me off to him was I presented to him the major contribution of the thesis, I didn't know it was the major contribution, on the elevator going between the sixth floor and the first floor. I mean that was how it went. He said, "Oh yeah, write it up." Then when he read it he said, "Oh yeah, that's really, really good." I mean that's not the way things should be done. You should be really working with. And I learned how not to be from him, and when I dealt with my own students I tried to be more empathetic, and to work with them closely. And that's what I really enjoyed. So that was my PhD.

**Q:** Who was your PhD advisor?

**Richard Klafter:** George Krantz [ph?]. Polish, but he was an older man. Not that old, but from my perspective at the time he was old. Oh he would be dead by now I'm sure. The thing that happened with me is I really did almost two thesis. The first one I started working on, and I was cranking out the results, and I really enjoyed it. And what I was doing was trying to develop the equivalent of a Laplace transform for difference equations, discrete time systems. And I was cranking out the results, and it was great. I really enjoyed doing this.

**Richard Klafter:** As any graduate student, you send away, you read papers, you send away for papers, and one day showing up in the mail was my thesis. So I had to drop it, and I thought the world had come to an end. Well it turns out that field disappeared, and I got into automatic control, and it was the greatest thing that possibly could've happened

to me. So I really, really enjoyed it, and I felt I enjoyed teaching it, I enjoyed doing research in it. And then it led to robotics because it was kind of a natural thing. And you're gonna ask me how I got into robotics.

**Q:** I was even going to ask you how you got into automatic control.

**Richard Klafter:** Well basically I needed support, and this guy had some support, and I got this project from him, but I had to learn it almost all from the beginning because I didn't have any background in it at all. So, it was stressful, especially since now we had two children, and we had very little money, and it was very, very stressful.

**Q:** How did you get into robotics?

**Richard Klafter:** Well, in the Philadelphia area there was a computer users group, had nothing to do with IEEE, or anything of that sort, and I went to a number of their meetings. And one day they had a guest speaker, and this guy was one of the founders of a robot company, U.S. Robots, Mitchell Weiss. And he was a good speaker, young guy, good speaker, very passionate about it, and he really turned me on. And that's where it came from, I got really interested in doing this. And then I started reading about it. You know, when you go back to, I forget when it is, the early 80s I think, there weren't a lot of textbooks written. There were papers, but most of it was industrial robots, and it was seat of the pants, it was proprietary. And anyway, my department chairman said, "I want you to write a book on robotics." He first wanted me to teach it, but I had to learn something to teach it. And then he said, "I want you to write a book on robotics."

**Richard Klafter:** And so I decided to do that, and I got two colleagues, and we put the book together after a long time. It's difficult to work with people who don't live up to their side of the bargain, and that's what happened. One of them was great, the other one was not. He shall go nameless, the guy who held us back. But it turned out the book was really the first comprehensive textbook in the area of robotics. It was called Robotics an Integrated Approach. It didn't sell a lot of copies. I mean it's not a big field. And but people still use parts of it today. I know because I get royalties. The book is out of print, but when they Xerox it they still pay, so I get enough for a dinner.

**Q:** Who was the chairman who suggested you write it?

**Richard Klafter:** Oh it was the former President of IEEE, Bruce Eisenstein.

**Q:** What was the integrated part of the integrated approach?

**Richard Klafter:** Good question. At this point I don't think I can tell you that. It was a catchy title, okay? I think that was more of it. And we put a lot of stuff in, and people have asked to use, we've had a lot of problems that students could use, and people used to call and say can they use the problems in work that they're doing, and of course. It's nice when people say they want to use your work. That was a fun thing to do. So that's how I got into the area or robotics.

**Q:** Robotics was still a new field in a sense, how did you go about coming up with a textbook for the field?

**Richard Klafter:** That's a good question. Well we knew it had to have control, so I wrote the chapter on control. And it had to have computer stuff in it, and one of the colleagues wrote the stuff on computer. It had to have vision. Vision was starting to become important. The first chapter of the book was kind of a description of industrial robots, and classification of industrial robots and stuff like that. I borrowed heavily from Joseph Engelberger's book, and that was one of the influences also. And the thing that also influenced me was going to these robot shows. Even though they were industry oriented it was really fascinating stuff. And I truly enjoyed this, and to me the field was fun, and if it isn't fun why do it?

**Q:** What were some of the robot shows you went to, and the kinds of things you saw?

**Richard Klafter:** Oh well, they had the ones in Detroit, or at Caldwell Hall [ph?]. Terrible, I don't remember the name of the show, but it was the big industrial robots show where all the manufacturers, at that time there were a lot of manufacturers in the United States and in Europe, and they would bring their robots, and the thing was loaded with robots all doing these amazing things. And it was colorful that's the other thing. The colors of these things, I mean it had to draw your attention. It was just marvelous to go there. And I enjoyed it immensely. I went to some of the talks, but they weren't as especially technical. But anyway, they were interesting shows to go to, not like the ICRA. Not saying that ICRA isn't interesting, sorry. That was <inaudible> spunk there.

**Richard Klafter:** I mean it's a different type, this is industrial, and they were, for the most part, industrial robots. They were interested in grippers, and picking up lots of heavy things. It was a fun thing to go to, and I've always enjoyed being associated with people in the robot field. So it was good.

**Q:** What was the first actual robotic system that you worked on?

**Richard Klafter:** Well actually I consulted for U.S. Robots. So I had an opportunity to really apply some of my diagnostic skills. They were having problems, and I learned some interesting things about when you go and you buy parts. They used, I don't remember the name of the component, and most robot companies use the component. It's not a gear, but it's sort of like a gear. And it was used, and probably still is used, by most of the industrial robot companies. And they were having problems because there were vibration problems, the robot with the arm would go, and then it would shake in a certain sections, and it was repeatable. And so I instrumented up, and I took a look at the current, and we could see what was happening that the current was actually really going high, and there was something going on.

**Richard Klafter:** Well it turned out that one company made this particular component, only one in the United States, a German company, and it was derived from garden implements. It was a way of multiplying torque. And what happened was they adapted it for robots, and so when they put this thing in the robot they had problems. It turned out that the numerical control machine that was actually making these, for want of another name I'll call it a gear, this gear was actual machining them was defective. And they were producing defective components, nobody knew this. And we finally called it to their attention, and they had to change the machine to do it. But it was a very interesting thing.

**Richard Klafter:** I learned a great deal about the practicality of engineering. Here I was professor of engineering, never having practiced engineering. After I did consulting I realize how can you call yourself an engineering professor when you don't practice engineering? And so this gave me an opportunity to practice in the field of robots, and I worked with them, I consulted for a number of years. Unfortunately they went out of business, not because of me. But the field became very difficult, and it was, I think, a mini recession, or something like that, and people weren't buying robots, and so companies couldn't survive. And today I don't know, I think there are only a couple of industrial robot companies in the United States. Now they're made in other countries, but in the United States it went from a very large number to only a few.

**Q:** When did the mini recession happen?

**Richard Klafter:** In the 80s, late 80s. And it was a shame that that took place. And the United States lost the edge that it had in robots. And the other countries, of course, didn't suffer as much. Today it would be probably a different story, but the economic pressures in other countries are not the same as they are in the United States. The companies

here, they got to make a profit, people don't buy they don't make a profit, and that's what was happening. It was interesting that that took place, and sad. It was really sad because we did lose the edge, I feel.

**Richard Klafter:** But the advances that have been made in other parts of robotics have been amazing. And I think that the Robotics and Automation Society is in large part responsible for it, even though it's more of an academic kind of organization. I mean it still has contributed to the advancement of the field, greatly contributed. And I like to think that in part I had something to do with that. Let's see, I'm trying to think. I was involved with control, and I was thinking back trying to prepare a little bit for this, trying to find out how I got involved with the committee that formed the Robotics and Automation Society, actually at that time it was a counsel. The first one was a counsel. And that's IEEE speak, so to speak.

**Richard Klafter:** Anyway, this forming committee got together a group of us, and one thing led to another, and over a period of some time, and all of a sudden we petitioned the IEEE to have a counsel, the Robotics and Automation Counsel. And so we had this small group of people, and we found that there were lots of people out there who were interested in this. And I was associated with the Robotics and Automation Counsel, and then the Robotics and Automation Society continuously until after I ended my presidency, which I found out was in 1995. I couldn't remember when it was. I still continue to do some work for the Robotics and Automation Society. But it was a good long period, and I saw the society grow tremendously. And, for me, it was as highlight of my career being associated with Robotics and Automation Society.

**Richard Klafter:** Not so much because of what we accomplished, that was important, but because of the people I worked with. The people in the society were the greatest people I have ever, still to this day, ever met. They were unlike some groups that I was associated with, they were only interested in furthering the society. There wasn't any I'm important, I'm important, there was none of that. The society is the important thing. Whatever we do we have to do it to make the society improve and succeed, and that's the way it was. And a good part of that came from the founding president, George Saridis, and he was really a major force. And his legacy persisted for the longest time. And I don't know whether it's still that way, I suspect that it's still is to a large part. But anytime you deal with people you have some personalities involved, I didn't find that there were personalities. So it was wonderful dealing with the people, and interacting with the people, and I got a chance to meet people from all over the country, all over the world, and, as I said, it was a highlight of my career being associated with the Society and finishing up as president. That was a marvelous experience.

**Q:** Who were some of the people that you worked with on the original Counsel?

**Richard Klafter:** They still exist today, they're still around, T.J. Tarn, of course George Saridis, Dave Oren [ph?], and I go back a long time, and Nick Volsse [ph?] who has done a marvelous job with the transactions, George Beckey [ph?], he really did a marvelous job on the transactions. He was the one who really brought it up to a very high level scholarly publication. And let's see, who else? The problem I is I don't want to leave people's names out. I'm just trying to think. There were a number of other people, but those are the ones who come to mind just now. I'll probably think of them after I finish with you, and I'll run back.

**Q:** You can always blame our editing on it.

**Richard Klafter:** So, yeah, this group is truly, I think it's a rather unique group because of what has happened over the years. I haven't kept up with the finances, what's involved, I was involved with the finances. I was treasurer for a while, and then vice president for finance, and then I became president. So we were very much interested in running a balanced budget, and funny thing is I talked to George Beckey today, and he became president after I was president, he said, "You left me with a deficit." I had no idea. I didn't realize that. So I apologize. But, yeah, we were trying to be fiscally responsible, and so this is a good group, it's a good group of people. And, as I say, I think that the society has truly furthered the cause of robotics in the world today.

**Q:** What are some of the ways that you think it's done that?

**Richard Klafter:** Well, the transaction certainly was important, then the development of the International Conference of Robotics and Automation brought a lot of people together who could present results before they were really in a form that where they could be in a paper, not paper form. And people could read this and build on that, and I think the conference helped people to go beyond what the transactions would do. The magazine was an interesting development. It wasn't a magazine, it was an eight page, or a 16 page paper thing with no glossies, no color, any pictures were black and white, and it was really a newsletter. That's what it was. And then we looked at some of the other societies who had magazines, and there was method to our madness going over to a magazine.

**Richard Klafter:** The IEEE has some strange rules. When you pay your dues part of your dues comes back to the society, and the percentage is based on the number of pages that you publish, and things of that sort. Newsletters don't count. Magazines do.



And so there was more income that we could get from the IEEE when we had a magazine. Looking at the magazine today it's really slick, and a good part of that, the reason for that, is Roz Snyder. She remembers when it was a newsletter. So she's been very instrumental in proving things. And that has helped the society. I don't know what the finances of the society are, I wasn't privy to that after I left, but I suspect if they can afford to bring the presidents back, and pay for us, which incidentally never would've happened under George Saridis. I think he's turning over in his grave about this, but it's a very nice thing to do, and for me it's great. I was in the hotel lobby checking in and all these people came by, and people I knew very well, and it was great seeing them. And I hope to see even more at the banquet tonight, and the president's dinner tomorrow. It's a good organization.

**Richard Klafter:** It also gave me, when I was president, one of the things you get to do is to go to the technical activities, the IEEE overall technical activities conference. It's a meeting. It's not a conference, a meeting. And a lot of that is it's a lot of drudgery, but you get to meet the other presidents. At that time I think there was something like 45 or 50 presidents, and I interacted with presidents from other societies, and there were some really good guys and lady-- there weren't too many ladies who were president at that time. I suspect that's changed now. But it was a good experience, and I can say that TJ Tarn was very responsible for raising our understanding of how the IEEE works with respect to money. Prior to TJ I don't think we had a good understanding of what you had to do to get your share of the pie. You really have to go in there, and it doesn't come automatically. And you get some, but you can get more if you really push, and he understood that. And the thing about IEEE there's no manual that tells you how to be a president. There may be one now, but in dealing with IEEE there's certainly no manual. You just have to learn. And so it was a good experience there, too.

**Interviewer:** Going back to the foundation of the RAS was there something about that moment in time or in history where it really felt like it was time for robotics to come together as a discipline? It's a very kind of interdisciplinary or cross-disciplinary pursuit.

**Richard Klafter:** Yes, it is, very.

**Interviewer:** Why did it come together then?

**Richard Klafter:** I can't put my finger on it. Maybe it was time. As you point out there were things that were pushing in that direction, and I guess there were people who were farsighted enough to see that it was time that we had a robotics component of the IEEE. And the good thing about IEEE is that they were open to establishing a new society like this, and of course the founding people were basically spin-offs from the Control Systems

Society. Almost all of them belonged to the Control Systems Society. Everybody belonged to the Control Systems Society, and we saw that there was this need. It was beginning to grow. People were starting to do a little research in the field. There of course was the industrial robotics, and of course the automation tag came in because of the industrial components. And that of course has always been difficult with respect to the conference and the transactions on robotics and automation, and at times it was difficult to get papers written on automation because the people who might write those papers were industrial people and they don't get paid to write papers, so it was a little difficult at times. But we tried to include that as much as possible.

**Interviewer:** If everybody was part of the Control Society then why did you particularly feel that-- what was it that you couldn't get done in the Control Society that you felt a new group would help you accomplish?

**Richard Klafter:** That's a good question, and I don't know the answer to it. I really don't know the answer. No, I don't. It's a good question, and it's funny that I never gave it any thought, but it's an obvious question. Don't know. Yeah, it could've easily been included as a technical activity within the Control Systems Society, for sure. I don't know whether it would've gone as far, the whole field. I don't know whether this would've burgeoned the way it did under the Robotics and Automation Society as a separate entity.

**Interviewer:** Was there a sense amongst the people who came together to form robotics that they were already doing robotics prior to that and identified themselves as roboticists?

**Richard Klafter:** To some extent, sure, yeah, people were doing this. I don't know how much research was going on at the time. You know, it's the eighties. There wasn't a great deal of research. There was research. The research, of course, came from the academic side, for the most part. I mean industry couldn't afford to do a lot of research. They had to produce a product and make a profit. So it was the industrial people who kind of pushed, and then the academics got involved with the research aspect. One of the questions I think you had earlier was what kind of projects did I work on. I got involved with mobile robots. I found these to be very interesting, and I had a group of students working on mobile robot projects and, again, it was a fun thing to do. They enjoyed it tremendously. And the problem was it was difficult to get funding at the time. Funding had kind of dried up, to some extent, and the mobile robots were not viewed at that time the way they are today. They were viewed more as a practical kind of thing, industrial, and so it was difficult to go to NSF or DARPA and get funding from them. I got some funding, but not a lot.

**Interviewer:** Did you get industry funding for your work?

**Richard Klafter:** That was a bad time to get funding from industry, right. It was difficult. See, the European people didn't have that problem. The Japanese people certainly didn't have that problem at the time. I mean I was amazed when I went to Japan and I found that every faculty member got this amount of money from the government and this amount of money from industry, and it was almost automatic. And they were able to have lots of students and big labs, and they did great stuff, and the Japanese have done wonderful stuff in the area of robotics in both the industrial as well as the nonindustrial types of robots and various types of assist devices, so it's been-- unfortunately in this country we tend to be shortsighted, and it bothers me, but what are you going to do? <laughs> That's the way it is. So it's hard to change the system. That's the way it was.

**Interviewer:** What were some of the industrial applications that mobile robots were being used for at the time?

**Richard Klafter:** I know one of them was in firefighting they had tried to adapt a mobile robot onboard ships to fight fires from aircraft carriers. Fires are a real problem when the planes crash and they've got to put out fires, and the men come out in these suits, very dangerous. So they kind of envisioned having mobile robots do that. Of course, the things they are used today, they use mobile robots to go into structures where there might be a bomb and sniff out bombs and blow them up, sacrifice the robot instead of the man. Then, too, people have used the mobile robots in research for artificial intelligence, you know, trying to put learning into the mobile robot and path planning, very important at the time, still is, probably. And it was an interesting area, and I suspect it continues to be. I'm not as up on the field as I used to be. As I said I've gone into other area, but every so often-- I still get the transactions and I look at it and I'm amazed at the things that go on, so it's interesting to see the developments in the field of mobile robots and robotics in general.

**Interviewer:** What were some of the mobile robotics projects that you worked on?

**Richard Klafter:** Well, let's see. One of them was a window-washing robot that climbed up the wall. I was involved with a company that did this, and we put it together. And unfortunately the guy, the principal, the president died suddenly under peculiar circumstances, and so the company disappeared, and nobody really picked this up. I wasn't totally convinced that this was a viable application. I worried about-- what happened was you lowered this thing down like you would lower a man on a platform, but this thing came down the wall and carried the solution to wash the windows, and it crawled down and had grippers. The problem is in our tall building you have these strong

winds, and I worried about the thing breaking loose and smashing through a window and people getting hurt. And I raised the issue but they didn't want to hear that, but it never amounted to anything. So that was one.

**Interviewer:** What was the name of the company that was involved with it, if you remember?

**Richard Klafter:** Gosh, that's terrible. I don't remember. Oh, my gosh. It'll come back to me, but I don't remember.

**Interviewer:** If it does you can just email us. We're just curious to know those kinds of things. <laughs>

**Richard Klafter:** Yeah, yeah, yeah. One of the projects that my students worked on was something that could've been used in space. Basically the robot had two connectors, one on each end, and it was-- I'm looking around for the language. The language, as I said, sometimes escapes me. It was an articulated structure that could plug one end into a hole and then operate like a regular robot, move to another. There was a grid of these, and that's how it moved around.

**Interviewer:** I think I've seen this.

**Richard Klafter:** It's possible. It's possible, yeah. And we worked on this, and so I had some good students. Unfortunately <sighs> the students-- I don't know whether they lost interest or-- they graduated, that was for sure, but what happened was the project stopped because I lost the students. I didn't have the funding for them. And I thought it was a pretty good idea, and it could certainly have been used in a space application. And we actually built a small prototype and it kind of worked. I had to teach these kids all about control-- how to use motors. That's my strong area, motor control. And even though they were mechanical-- it was a cross-disciplinary group, mechanical and electrical engineers, but they don't get that kind of thing in class. I had to teach them these things, and that was good. They learned. They appreciated it, too. So, yeah, we had it sort of working. <laughs>

**Interviewer:** So who were some of your students who have had careers in robotics?

**Richard Klafter:** <sighs> I'm trying to think. Most of them did not continue in the field, okay? They did not go on, which happens. I mean it does happen. I think the training

they got was good for what they did. I haven't kept up with many of my students, either, and that's a shame, but that happens sometimes. One of my students was the one who coauthored the book, and so he was really good.

**Interviewer:** What's his name?

**Richard Klafter:** Tom Chmielewski. It's pronounced the way it's spelled. <laughs> No, he's really good. He was always an excellent student. I guess he was my best student, and we got along very well. And he held up his end of the bargain completely, and now basically I've told you the one who didn't because if you look at the name there are three names. So by the process of elimination--

<laughter>

**Interviewer:** Who are some of the other people you've collaborated with over the years in research and other things?

**Richard Klafter:** <sighs> Oh, boy. That one I didn't expect. I'm sure it will come to me, but I cannot really remember. It's terrible. It bothers me. It bothers me that that's happening, but it happens.

**Interviewer:** It might be easier to think of specific projects and who you worked on a specific project with, maybe. What were some other robots after the window-washing machine?

**Richard Klafter:** Well, there was this rectangular array thing. That was a major one. I'm trying to think. <laughs> It's difficult for me to remember. I'm sorry. I told you this might happen, and it is. I'm amazed that I'm able to dredge up as much as I have at this point.

**Interviewer:** What brought you to Temple after Drexel?

**Richard Klafter:** Well, one of my former students was a faculty member there, a very good student, and they were trying to expand. At that point they had what was called electrical engineering technology, and they were looking to expand to engineering and also to develop a graduate program. Now I was strongly involved in graduate programs, and so he asked me whether I wanted to come, and I wasn't all that happy at that point at

Drexel and I was looking for a change. Seventeen years is a long time to be at one place. And so I went, and it was a good time. I helped develop the graduate program. I think I made an impact there. And we improved the curriculum, curriculum development. Temple is still not a major player, but we produced some very good students, excellent students. But that was the reason I went to Temple. I should also say that the bump in salary didn't hurt. <laughs> But that wasn't the major reason, but it didn't hurt.

**Interviewer:** What was the name of the student that was there?

**Richard Klafter:** Oh, it was Brian Butz, B-U-T-Z.

**Interviewer:** What year was that that you moved?

**Richard Klafter:** Let's see. I was there <mumbles>, working back about 1987, '88, something like that, '86.

**Interviewer:** Oh, so it was pretty early.

**Richard Klafter:** Oh, yeah, sure. Eighty-four, maybe.

**Interviewer:** So the UPenn robotics wasn't really up and running when you were at Drexel.

**Richard Klafter:** No, it wasn't, and it was a small group. They were more into biomedical engineering at Penn, and that was one of the things I did at Drexel, actually. I was in the biomedical engineering department. That was part of electrical engineering, and I did some research in that area, the area of cardiac pacemakers. Actually, I applied optimal control to the control of cardiac pacemakers, and that one I got funded by the NSF, so it was good.

**Interviewer:** What were some of the other sources of funding that you had over the years?

**Richard Klafter:** NASA and--

**Interviewer:** Did they fund the rectangular array--

**Richard Klafter:** No. No, they didn't. They didn't. It was kind of a general-- and let's see. I actually had limited funding. I didn't have a great deal of funding, and I think to some extent it was because I was very much interested in teaching, and as you probably know if you're interested in teaching it's difficult to succeed academically. I think I succeeded academically, and I think I graduated a lot of students and I taught them well, and I think that they went out and they did well. So I think I had an impact in the field. But I liked teaching, and it was only the last three years that I decided it wasn't going well. But I really enjoyed teaching. I enjoyed working with students. I never envisioned myself retiring. I thought I'll go forever. But things change, and they changed, and it wasn't fun anymore. And if something isn't fun why do it? Go on to do something else, and that's what I do now. I enjoy what I do.

**Interviewer:** What's your advice for young people that are interested in pursuing a career in robotics?

**Richard Klafter:** In robotics? <sighs> Get yourself a good advisor and work hard. Work very hard, and get as much background as you possibly can even though it doesn't appear that it'll be relevant to what you're doing. You don't know that it won't be relevant in the future. And these are things that I learned, and this is the thing that you learn as you get older. You have a very narrow view as a young person of what's relevant and what isn't, and so a broad background is important, no question about it. Also, get involved with a group like Robotics and Automation Society. It's important. You get to meet people. You get to exchange ideas, and that's how you learn. And it piques interest in a particular area that you hadn't even considered, and that's what's really important. And I think we've done that in this society. There are a lot of young people-- I'm pleased to see that there were so many young people. When I was president I tried to nurture the younger people, get the younger people involved in the society. You know, they weren't old, but they were the old-timers, okay, who were associated with the society, and I wanted to get younger people involved in the society. I thought it was good for them to see how it was run, to make contributions to the society that they could. They bring another perspective, a younger perspective to it, and we did. We did do that. And of course with the competitions that are now being run that are being sponsored by Robotics and Automation Society, this is one way to do it. And of course now every high school kid, every elementary school kid is interested in robots. Now, they're not exactly the robots that I would say are the kind of robots that I was involved with, but still it's the interest in it, and hopefully a small subset of those kids will go on and perhaps make contributions to the overall field of robotics and automation.

**Interviewer:** What's your advice to young teachers and professors and future advisors?

**Richard Klafter:** <laughs> Well, if you want to be successful and advance you have to do a lot of research and work with students. That's the joy, and I can tell you if you don't work with students you're missing out on an important part of academics. It's a fun thing to do. Students really get you going, and that's what it was for me. I just love working with students. And you have to learn to play the game, the funding game and write lots of proposals and that takes time, but it's necessary. That's the only way to do it, especially if funding is scarce. So you have to go out there and try different sources. It's difficult. I don't know what it's like with NASA now. NASA used to be a major, major source of funds. Now that NASA has been cut way back they probably don't fund as much as they do. So, yeah, teaching at the university level is a marvelous experience, and I would highly recommend it to anybody who feels that they can put up with some of the subsidiary kind of stuff that you have to put up with, administration and the chores that come along with being a faculty member. But going into the classroom, working on research projects with students more than makes up for it, absolutely more than makes up for it. And of course it doesn't hurt if you're at a school where they nurture the faculty member. They let the faculty member pretty much have a lot of autonomy in what they do, and there are lots of schools that are like that; not all, but many of them are, and so it can be a great source of pleasure. One thing, you know, if you're working a job that you don't like you're always tired. You can't wait for the day to end. I never felt that way. I've always enjoyed it, at least until the last three years. <laughs>

**Interviewer:** And if you had to then define what a robot is what would you define it--

**Richard Klafter:** I'm sorry, say again?

**Interviewer:** What a robot is. What would you say a robot is?

**Richard Klafter:** Well, it depends on the kind of robot. And industrial robot is there to help the human being do things that a human being couldn't do because of strength limitations, danger and things of that sort. So that's certainly one definition, an assist for human beings.

**Interviewer:** So you were explaining robots. The definition--

**Richard Klafter:** Definition. I wouldn't give it a def-- I mean there are book definitions of what a robot is, but--

**Interviewer:** We're just curious about how would you-- since you've done work in this area how would you tell people about robots?



**Richard Klafter:** Well, I think the definition has changed. Where people are using robots or robotic-type device-- they're using robotic-type devices, which really aren't robots. They're more telekinetic devices, which the laypeople think is a robot, but it really isn't-- but in the medical field and doing some marvelous work with robotic surgery, and so again it comes back to helping the human being because it certainly does help the human being. Surgeons are able to do the kind of surgery they do now that they couldn't ordinarily do without the use of these telekinetic devices.

**Interviewer:** And so what basically makes them not a robot is that they're not autonomous.

**Richard Klafter:** They're not autonomous, exactly. Now, I think it's going to be a long time before a robot does surgery on a human being without the surgeon there. <laughs> I think that would be-- I don't know whether I would ever want that, whether we could trust the robot. Things happen, and-- yeah. Let's see. What other areas? Certainly helping people. The idea that mobile robots could go into a burning building and examine. They used mobile robots at Chernobyl to see what was going on. To put a human being in there would be essentially sacrificing the human being. So the robot is really something that can be used to help the human being to assist what the human being is able to do and to go beyond the capabilities of a human being, and that's certainly-- I don't know whether you would call that a definition, but for me that's an important aspect of robots. I remember when I was first involved with industrial robots one of the things that they said was that robots could work in areas that human beings couldn't work in because they were dangerous, and they cited spray painting in automobile assembly, that these people would go in. They'd have their masks on and shields and everything and they'd be in there, but still they got sick. And also they didn't do the best job. A robot is immune to that kind of stuff, and it can be a superior job to the human being. It puts down an even coat of paint, and it's just the right thickness, and it does a marvelous job on the automobile. You take a look at the finishes on automobiles today, and they're really remarkable compared to what they used to be. I guess if I had to put my finger on one thing I would say the helping of human beings.

**Interviewer:** Great. Is there anything we missed or anything you'd like to--

**Richard Klafter:** Oh, I'm sure you missed, but--

**Interviewer:** Anything that you'd like to add?

**Richard Klafter:** Add? Hmm. No, I gave a little thought to this beforehand but not a lot, and I probably should've done more, but I felt it would be more spontaneous. This is certainly spontaneous. <laughs> I hope I don't have a lot of "Uh.. uh.. uhs..." in it, but <laughs> it's been a long time since I gave a talk of any kind. It is, but I've always enjoyed giving talks. But I would say that pretty much sums it up. You've asked good questions. They were really good questions, and they pointed me in the right direction, so I appreciate that.

**Interviewer:** Well, thank you, and you told us I think a lot about especially RAS that we really did not know--

**Richard Klafter:** Oh, you didn't know.

**Interviewer:** --that was really useful, yeah.

**Richard Klafter:** Oh, good, good. I'm glad I could help. Yeah, yeah.

**Interviewer:** And also understanding kind of the camaraderie and the importance of it is really interesting.

**Richard Klafter:** Absolutely. Oh, the camaraderie. Camaraderie has been a big thing, and still to this day I suspect that it's still the same. I mean I don't know, but why would it change because you grow up in a culture and these people come through, and the culture is like that so you adopt that culture as part of your own. So I would think that it probably is to a large extent still. I really appreciate you giving me this time to speak about it.

**Interviewer:** Well, we appreciate you <laughs> taking the time. Thank you.

**Richard Klafter:** Good, good.

#### End of RichardKlafter.mp3 ####