# ORAL HISTORY: Herman Blinchikoff

## About Herman Blinchikoff

A Life Senior Member of IEEE, Herman Blinchikoff began working for Westinghouse Corporation in 1952 on a work-study program at Johns Hopkins University in Baltimore. He earned a Bachelor's degree in 1959, and his Ph.D. from Johns Hopkins in 1968. During four decades as an engineer at Westinghouse, Blinchikoff worked on electrical wave filter and helical filter design and radar system engineering, publishing his first paper, with Anatol Zverev on helical filters in IRE Transactions in 1961. He has four patents, including one for an intermediate-band crystal filter with low-transient response. Blinchikoff retired from Westinghouse in 1992, to begin a second career as an educator in Maryland community colleges.

In this interview, Blinchikoff discusses his work at Westinghouse, and the transition from analog to digital technologies. He also addresses Westinghouse's change in strategy and investment in media and broadcasting under Michael Jordan in 1990s and the merger with CBS.

## About the Interview

HERMAN BLINCHIKOFF: An Interview Conducted by Sheldon Hochheiser, IEEE History Center, October 14, 2010.

Interview #559 for the IEEE History Center, The Institute of Electrical and Electronic Engineers Inc.

## Copyright Statement

It is recommended that this oral history be cited as follows:

Herman Blinchikoff, an oral history conducted in 2010 by Sheldon Hochheiser, IEEE History Center, New Brunswick, NJ, USA.

# Interview

Interview: Herman Blinchikoff
Interviewer: Sheldon Hochheiser

Place: The National Electronics Museum, Baltimore, MD.
Date: 14 October 2010

## *Early Life and Education*

**Hochheiser:**

It is October 14th, 2010. I'm Sheldon Hochheiser of the IEEE History Center. I'm here at the National Electronic Museum in Maryland with Dr. Herman Blinchikoff. Did I get that right?

**Blinchikoff**:

Perfect.

**Hochheiser**:

To listen to him talk about his career. Good morning

**Blinchikoff**:

Good morning.

**Hochheiser**:

We could start with a little background. When were you born?

**Blinchikoff**:

I was born August 3rd, 1934 in Baltimore, Maryland.

**Hochheiser**:

Were you raised in Baltimore as well?

**Blinchikoff**:

Yes, I was raised in Baltimore, Maryland.

**Hochheiser**:

What did your parents do?

**Blinchikoff**:

[Chuckling] My mother Cecelia was a homemaker and my father George had various endeavors. He sold shoes for his father in their shoe store. Then he became a bookmaker, which was not uncommon in those days. After that, due to certain changes in the law, he decided that bookmaking was not for him and he purchased a pool room. Over time he got disgusted with the business and sold it. Amazingly, everybody said he couldn't really work at a normal job, but he did. He tried selling automobiles. He was honest and a good talker. He liked it, wound up doing that for the next 20 years, and retired at about 70. So I have a very varied background from his experiences also.

**Hochheiser**:

Were you interested in technology and science as a youth?

**Blinchikoff**:

I was always interested in mathematics. I thought I might like chemical engineering, because I had a chemistry set and was always in the basement experimenting. And I had the old erector sets to play with as a youngster.

But I never really thought much about what I wanted to do as a profession. So when it came time to make a decision in high school and where to go to college I said well, I'm going to try chemical engineering. I was enrolled at the University of Maryland. Now this is the spring of 1952, the year I graduated. I went to Baltimore City College, which is a high school, the third oldest one in the country and an all-boys school. At the end of one assembly, after the principal dismissed us, Dave Kaufman, a guidance teacher, rushed onto the stage for an announcement. Now 1,200 or 1,500 boys starting to leave, didn't really stay to listen to what he said but I listened. And I heard words like scholarship, Westinghouse, Johns Hopkins. So I went to his office and he said Westinghouse and Johns Hopkins University have combined to create a work-study program and they're giving a test very shortly to see who qualifies. He advised me to take the test. I told him that I've already enrolled at Maryland. He said don't worry about it, take the test. Three people from City College took the test and two of us were fortunate enough to pass it.

Our next requirement was to be interviewed by a Westinghouse manager. And I was interviewed by a man named Nick Petrou.

**Hochheiser**:

Who I've heard of from other people.

**Blinchikoff**:

At that time he was an engineering manager. Of all the questions he asked me, the only one I remember today is do you expect to become rich being an engineer. Well even at 17 years old I knew that was a loaded question and I'd better answer it honestly. And I told him that I do not expect to be rich but I expect to make a comfortable living.

In the ensuing years Nick Petrou rose up to be president of the Westinghouse Corporation in Baltimore and I believe he even was a vice president in the national corporation. So two weeks after I graduated high school I was at Westinghouse working 32 hours a week for 35 dollars per week. They had courses already set up for us at Hopkins. Sometimes the instructors would come to us. Most of the time we went to Hopkins. The idea was that we would continue this for three years. At the end of three years if you made it through, you would be given a certificate in engineering and have the full rights of an engineer just coming out of college. However they encouraged us to go on for a Bachelor's, which we did under the normal Westinghouse evening school program. And I continued with that until I received my Bachelor's degree in 1959.

**Hochheiser**:

So all the time you are working at the facility here in Baltimore while you are simultaneously doing your engineering coursework at Hopkins.

**Blinchikoff**:

Correct. It was a work-study program; for the first three years; they organized all classes, we did nothing, we just knew where to go. After three years we were on our own. But it was then under the sponsorship of the evening school program, as I previously mentioned. I paid the tuition for each course. My tuition was refunded if I passed the course. If the course was not passed, no refund.

**Hochheiser**:

That's a good incentive.

**Blinchikoff**:

Yes, but for the work-study part, the first three years, we paid our own tuition. At the end of each course we received half our money back if we passed. Westinghouse kept the other half. If you made it through all three years, you received all your halves in a lump sum, which was a real incentive. We were the first class, the first time they tried this program. They wanted to home-grow their own engineers through the Westinghouse system. There were many roadblocks because the program was pushed ahead too soon. They really wanted to wait another year. For example we had a 12 or 18 week tour in the shop and that was horrendous because the people there were working to make money. And here we were to learn. They had what was called piece work in those days. They'd have a group of five people and they got paid on how all five did. So the weakest link really got beat upon and so to throw us into that was really not fair.

**Hochheiser**:

Right. Besides everything else these are guys who have all been doing this stuff for a long time, and they know how to do it

**Blinchikoff**:

Right. That's right. But we learned a lot from that.

**Hochheiser**:

I bet.

**Blinchikoff**:

We learned a lot, especially the time study routine where a time-study man came by and watched somebody work He timed them a few times, averaged the results and obtained a working time for that job. And then when it came time for the person to actually do the job he zipped through, thereby earning more pay because he could do more jobs [Laughing]

**Hochheiser**:

But after 12 or 15 weeks of that, what did they do, rotate you for the first 3 years to a variety of experiences??

**Blinchikoff**:

They would send us around. That's correct. After our tour of duty in the shop they stopped it for future classes. They said this doesn't work. Now in the process of going from one group to another I got a very, very big break in my life. There are certain times in your life where opportunities arise. You might not realize it at the time but they're turning points in your life. One of my assignments was with a group called components engineering. Now this was a group that designed inductors, transformers, and electric wave filters. I was told that there's a man who doesn't have secret clearance yet so he cannot work at the Wilkens Avenue plant. He works in the warehouse that houses the carrier microwave section. He's Russian and he's our expert on electric wave filters. They said we'd like you to go over there. Well once I met him and started working with him, it was clear to me, very fast, that I wanted to remain in the filter area. It was just a perfect match. He had a background that was out of the storybooks. And I didn't even know all of it until many, many years later. He was a strict anti-communist and the stories that he told me, I remember to this day.

**Hochheiser**:

[Interposing] What was his name?

**Blinchikoff**:

His name, that's a good point, what's his name? [Laughing].

**Hochheiser**:

[Laughing]. You tell me these great stories about him.

**Blinchikoff**:

His name is Anatol Zverev. And he's a co-author of the book that I wrote with him. And we wrote many articles together. He was from the old school. He did things that today management wouldn't even allow and I don't even think they knew he was doing then. He would set aside about a hour, a hour and a half, not every day, but maybe two or three times a week to teach me. I had a teacher within the company, sitting there with him. This doesn't fit into anybody's budget [Laughing] and cost accounting but he did it. Evidently he liked me very much. I used to go to his house for dinner. I had him and his wife over to my mother and father's house. And when it came time for my next assignment I requested to stay with him and I did that for the rest of my three years.

**Hochheiser**:

Ah. So they were amenable to you to stop rotating once you found a good fit

**Blinchikoff**:

Yes. That was their goal. They figured even with our limited experience at some point we would find that. And most people did.

**Hochheiser**:

About how many people were in this program with you?

**Blinchikoff**:

Good point, I forgot to mention, 30.

**Hochheiser**:

Quite a substantial program.

**Blinchikoff**:

Only 90 took the test because it was not publicized very much being it was the first time. Thus 30 selected was an appreciable percentage. This program continued for about 18 years. I lost track after class 6 or 7. But we had the highest graduating rate of the first 6 or 7 classes; 11 of the 30 made it through the three years. It was extremely difficult for me at the beginning.

I was very active athletically and after school I was always doing something. And all of a sudden that stopped. I used to come home at 10 o'clock at night and tell my mother I'm going outside to run around the block a few times just to relieve my stress. And after a while I wondered is this what it's supposed to be like? [Laughing] So I went and talked to Stan Block, the coordinator of the program. He said that this is not unusual. Other people have come and said they do different things when they get home to relieve the stress. But after a while I got used to it. Look, it was two weeks from the time I graduated high school to the time I started at Westinghouse.

**Hochheiser**:

Yes, certainly working that combination of hours at Westinghouse, plus curriculum at Hopkins, I can understand why there was stress. Probably didn't leave you much time for much of anything else

**Blinchikoff**:

Not in the beginning. For me it was just too sudden a transition. Later I learned to include outside activities.

**Hochheiser**:

Right.

**Blinchikoff**:

After we received our certificate we went on a 40-hour week. And you could attend school at your own pace. During this time I became classified 1-A for the military service. I took my paperwork to Industrial Relations. They told me that I was considered a critically-skilled employee and they would get me a six-month deferment. They also said that I would have to repeat this every six months. Well I did this for a couple of years as did other class members. Then I and a friend, Jerry Kearns, who was also in the course, decided to join the reserves so that we wouldn't have to get deferments until age 35.

This way we would satisfy our service requirement in six months. So [Laughing] we tried to enlist in the Army reserves and they said they're not taking anybody. We went to the Navy; they also were not taking anybody. They suggested the Coast Guard. So we went to them and enlisted. We went to Cape May, NJ for three months, but a new law was enacted that reduced the stay for critically-skilled personnel. So after three months, we came back and again because of our classification we were not required to attend reserve meetings. We finished our obligation and I started back in the evening school. By 1959, 7 years after I started, I received my Bachelor's degree.

**Hochheiser**:

Which considering the workload you had at the time is pretty good.

**Blinchikoff**:

Yes it was.

## *Anatol Zverev and Wave Filter Design*

**Hochheiser**:

So after three years from when you started on a full 40 hours schedule, you have a regular assignment.

**Blinchikoff**:

Yes. I worked with Anatol. Now you have to consider the times and where electric wave filter design was in those days. The computer in the main building was just being installed in 1955. They had three people assigned to the computing facility. There was a supervisor, a section manager [chuckling] and another man who did all the theoretical work. But few engineers knew what to do with a computer. So they would go around like salesmen to different sections to try to explain what they had and see if they could be of use. Well, they finally came to us and explained what the computer could do. Electric wave filter design in those days included many equations that were usually not evaluated because of the numerical tedium. So we supplied them with the equations and they went back happy as a lark to program and generate the data. [laughing] They were so indebted to us for keeping them in business for at least a year that we had a special place in their heart. Anytime we had something that needed to be done, we would go to them, they would do it, push us ahead of everybody. In later years as things changed and that section manager was removed to fit into the larger scheme, another

person took charge. To me it didn't matter. As I had always done, I told him that I have a job to be done; can we have it by tomorrow? And he told me that my job would have to get in line. I told him that we never were put in line; we always had a special privilege because we kept you in business in your beginning. And he said well that's removed now. It's a different construction of the computing section. So at that point I felt a big change. But this was many years after our 1955 meeting with them.

Anyway, getting back to the equations. The design of electric wave filters in those days was as much an art as plugging into equations. The equations were established. They were established by people at Bell Labs 30 to 40 years before, people like Campbell and Zobel. It was called the image parameter theory. Design equations were fairly simple. You plunk the numbers into the component equations, you obtain the component values, you build it, and it didn't work. Most people would do that and finally they would get so frustrated they would give up and give the job to Anatol. So we always had people coming to our building with requests. He was the guru and it was an art in those days. The only company I remember that built filters was a company called Burnell. And they were in New York.

**Hochheiser**:

Now did they build filters for Westinghouse or was this just a company you knew?

**Blinchikoff**:

No, some people went to them directly. They were always in the mix when it came time to select somebody to design and build the filter.. But it was much nicer to have it done at Westinghouse where control could be maintained. I remember one of their chief engineers coming down and having a real fierce debate with Anatol on some subject. That was the only time I had contact with Burnell. The company was owned by two brothers, one of them I remember was Lou Burnell. The legend was that they had all their information in little notebooks that they kept in their pockets,. In other words, there's a lot of considerations before the filter parameters are determined and you would not know if you were correct until you built it. At that time we did not use the computer to determine the complete filter response.

**Hochheiser**:

Sure, you built and then you see if it did what you wanted it to do.

**Blinchikoff**:

Yes. And if it didn't, you maybe re-adjust components or re-calculate their values But it was not a field for a novice because it encompassed an art and a feel and experience. And that's what Anatol tried to teach me.

**Hochheiser**:

Right, right. So in a way, since it was still very much an art, it sounds like your experience in those early years was something akin to an apprenticeship.

**Blinchikoff**:

Yes, exactly. He was teaching me and showing me and we had the lab next to our desks. The lab was a table with coil winding machines and I used to sit there and wind them and test them. We had what was called a breadboard. You literally laid out the filter schematic (inductors and capacitors) just the way it looked in your figuring book, you supplied an input, connected your voltmeter, made a measurement, and you hoped it worked. And if you designed it properly it did. Then the next step was to take the filter and package it in a can. We did all that. We ordered the can. We ordered the components. I remember one time there when I called up a capacitor company to order capacitors. They took the order and I said I'd like to come down and pick it up. He said well where are you? And I told him I'm in Arbutus. He said where's that? I said it's in Maryland, it's right outside of Baltimore. He said you're going to come down and pick them up? I said yes. He said you know where I am? I said no. He said I'm in New York. I said how can you be in New York? I dialed a local number. He said well it's a new thing we have where you can dial a local number in Baltimore and get us in New York. That was the first time I'd ever been exposed to that [laughing]. Now everybody dials, they don't even know who they're talking to or where they are located [Laughing].

## *Chirp Filters*

**Hochheiser**:

I note during this period that you assisted in developing the chirp filter for a couple of FM pulse compression systems.

**Blinchikoff**:

That's correct. That was very interesting because one of the top engineers at Westinghouse then and for the next 20 or 30 years was a man named Coleman Miller.

One day he came over with Reuben Lee, the section manager of our group. Reuben Lee, a transformer expert, really was from the old school. He graduated college about 1924 and was very formal in his ways, a typical old-time engineer, and a very nice man. They explained to Anatol that Westinghouse was designing a radar employing linear FM pulse compression. I was sitting there, the year was 1954, maybe. They wanted him to build the pulse compression filter. Now this was something new. Nobody had built a radar employing pulse compression. Pulse compression is described as follows. You would like your transmitted pulse to be very narrow to obtain resolution. Now, if the radar wanted to have a longer range, the transmitted power had to increase Well if you start increasing the power on a very narrow pulse, you have to increase the amplitude. What this does, at some point, is saturate the transmitter tube. So you reach this limit of just how much power you can generate. Back in the 30's, Sidney Darlington at Bell Labs, who was a very famous engineer in circuit theory and other fields also, and Wilhelm Cauer from Germany almost simultaneously came up with this idea of pulse compression. And that is, instead of transmitting a very narrow pulse, you transmit a very wide pulse, but you code the pulse such that when you get the reflection back from the object, you have a decoding filter in the receiver that compresses the pulse and now your resolution is restored. So you have this property of being able to transmit a high power pulse because it's wide and not tall and yet have the resolution when you compress it. Although the theory was known for years, a lot of the delay in much of this area was due to the war, and the information started filtering out, pardon the pun, after the war. 1954 is not that many years beyond. Coleman told Anatol the critical design frequency. Can you build it? And Anatol, he can do everything, you know, he never refused, he never turned down anything. We could do anything. Of course he said yes. The calculation of the inductor and capacitor values was very simple, a couple of multiplications and division, and they were quickly calculated. Then the physical layout was considered. Anatol determined how to arrange the coils to reduce coupling between them, among other considerations. Then I set about winding the coils and assembling them in sections to see if they performed correctly. Everything seemed to be working. The final model, which contained 480 inductors and 480 capacitors, and I'm emphasizing the size here, was 12 boxes, each box was the size of the old cigar boxes, about like that, which when you stretched 6 boxes and then made a U with the other 6 boxes encompassed a lot of area in the equipment. Later the number of components was halved. There were a lot of problems with this because the elements, coils and capacitors, weren't ideal. And we started to get attenuation and it wasn't... I should back off a little bit. The decoding filter consisted of a cascade of all- pass sections. This filter theoretically has no attenuation, but it has the opposite phase of the transmitted signal and it's this characteristic that compresses the pulse. So when the signal returns, a nice compressed pulse is obtained. Well, the elements weren't ideal. We were getting attenuation across the band, so people had to swap the boxes to get a flatter

attenuation. Then it was incorporated into the radar. From what I know, that was one of the earliest, if not the first surveillance radars with pulse compression. Now, move up 20 years; there's a new invention, surface wave devices. The 12 boxes could now be replaced by a surface wave device the size of a stick of gum. Chris Vale was our resident expert in this area.

**Hochheiser**:

It's amazing how electronics has evolved. [Laughing].

**Blinchikoff**:

Oh, that is such a vivid example of technological advances.

**Hochheiser**:

And do you know what this radar system was used for?

**Blinchikoff**:

It was a surveillance radar, from what I remember.

**Hochheiser**:

Right.

**Blinchikoff**:

Yes, I don't know.

**Hochheiser**:

What you were doing was far enough removed from the products going to the actual customer …

**Blinchikoff**:

Yes. Especially at that stage of my career, I was just interested in getting the filter to work properly.

**Hochheiser**:

Right, now actually that was the question, trying to figure out the relationships.

**Blinchikoff**:

Now one other comment here. The article that was the bible of linear FM pulse compression was written by Sidney Darlington and published in 1960. This is 1954. Now, how did Coleman Miller know about this? In 1988 I went to Boston to give a talk to the IEEE section there on pulse compression signals. And seated there were literally the people that wrote the book on it, Charles Cook and Marvin Bernfeld. They wrote a book, Radar Signals, An Introduction to Theory and Application, that has been the chief reference for many years. Afterward I was talking with them and I asked Cook how could Coleman Miller know about pulse compression when he, who also was one of the early people in it, kept everything secret, not secret military-wise but company secret, because this was an important concept. He said well there's two things, two possible reasons. He said Coleman could have come up with it independently. I said it wouldn't surprise me. He's very sharp. Or, he said, when we came up with the concept, we sent out bids on tubes that could handle this signal properly. And Westinghouse was a big tube manufacturer. So if those specs were delivered to him somehow and as clever as he was, he could have pieced together [laughing] what was going on. I once asked Coleman and he was very vague on the answer. He was a very modest person on top of it so Cook's explanation to me was very reasonable. And I think he might have even come up with it on his own. But like I say, Westinghouse had one of the first operational radars. I think it was a Navy radar. Navy radars begin with S. I think it was the SPS-37 and then the SPS-43 that used pulse compression. But anyway I'm not that great on acronyms. [Laughing].

**Hochheiser**:

Actually it's part of the point, just to see how far away you were in your work from the actual final system.

**Blinchikoff**:

Yes. And physically we were far apart. We were in another building. Had very little contact. I would go over once a week or once a month to sit in a meeting but that was it.

**Hochheiser**:

Then in '58, according to what you sent me, you moved to the Carrier Microwave Division?

**Blinchikoff**:

Yes. The warehouse where Anatol and I worked, was the home of the Carrier Microwave Division. There just was no room in the main building at Wilkens Avenue so they had their own group over there and I became familiar with the people. They knew me. In 1956 they built what we now call the West Building at Westinghouse. Anatol and I moved there in October of '56. That I remember. And by that time they promoted Anatol to a section manager so he had his own section within this components group. He titled it Network Synthesis. Now, he still didn't have his clearance. His section was located in a special room for uncleared personnel in the West Building. It had a special entrance when you entered the west gate and that entrance is still there. And that would lead up to our room. Once you got to our room, you needed a key to get out of the room to the main building. You could come the other way with no key. Constantly people were streaming in and every time they wanted to leave they had to ask for a key to get out. Again, we had our own lab there. Now we had some more students from the Westinghouse course in it. We had other people from various areas. We had people who were pursuing their PhD's. They came to our section because of our reputation and because Anatol and his boss established a great relationship with the University of Illinois. So the section was getting to be known, papers were starting to come out of the section. And it really was almost like an academic atmosphere there the way he ran it. About that time, Christmas of '57, I was at a beer garden and there were people there from Carrier Microwave. I knew them. They called me over and they said, this is unofficial, but we would like you to come over and design a complete set of transmit and receive tone filters for our new system.

Well this was a real shocker for me. I'd never even thought about leaving Anatol. I did everything under his wing. I went back and discussed it with him, unofficially. And he said it's good for you. He said now's the time. You have to leave me, go there. And he said I'm still here, we're not that far away. If you need me or have a problem, you can always come and talk with me. We're still Westinghouse. So I decided to do that. I told them and then whatever they did they got me over there because there were rules in Westinghouse, you never go to another section and try to induce somebody to come to your section. This is not major league baseball where you trade people. They discouraged that but the need was such that it was just put through. I remember going there and they asked me if I needed anything. I said yes, I need a printing calculator. I said I have to have something that adds, subtracts, multiplies, divides, and prints so that

I have a permanent record of each design. I told them that each of the tone filters required a separate design and the printer would save considerable time. They said well what do you want. I said I want the Olivetti machine. They came back and said, can't get that, that's made in Italy and we have no type of relationship with them. I said well that's what I want. Do what you have to do. I got an Olivetti. I don't know what they did but I got it and I still have the tapes of these designs. I spent about a year there and also designed inductors, among other things. A mechanical engineer, Lou Hehl, and I came up with a way of tuning an inductor and capacitor to the proper frequency as the coil was being wound on the winding machine. Prior to this, we would wind the coil, remove it from the machine, and then manually add or subtract turns until it and the capacitor tuned to the correct frequency. The worst thing is having to add turns to it, [laughing] subtracting is easy. Like I said, we came up with a way to tune the inductor and capacitor to the proper frequency as the coil is being wound, and finally when the inductance was correct we'd stop the machine. I don't know if you've ever seen a toroid made of powdered iron or molybdenum permalloy. Try to imagine a machine that actually adds turns to the toroid. It's a very clever device. It includes a loop that opens and fits inside the toroid and then wire is added to the loop. Anyway, we figured a way how to do the tuning. They used it in the shop and it was very effective for tuning these circuits accurately without having to take each inductor and go through that normal tuning process.

After that particular job was finished the company made a decision to move the Carrier Microwave Division to Pittsburgh. Everybody was given an option to go there. And I talked it over with my parents. I said I don't think I'm going to do it. It probably would be good for my career, because I would move up but I like it here and I don't want to leave the family. I'm staying.

And of course there was no problem going back to Anatol. It was easy.

**Hochheiser**:

Right. Besides everything else you had a good place in Baltimore to land.

**Blinchikoff**:

Right.

**Blinchikoff**:

So they went up there. And that was an unbelievable experience they said. People in Pittsburgh were used to manufacturing big equipment, big stuff, big power,

**Hochheiser**:

The big stuff for the power industry. [Laughing]

**Blinchikoff**:

[Laughing] And here, we come up there and want a coil wound with a number 35 wire. They couldn't even handle it. They said it was comical for a while. Finally they couldn't make it there and they left. Some of the engineering section went to Leesburg, VA and others returned to Baltimore. The tone equipment went to Newark, New Jersey. And one time they asked Anatol and me to come up to see what they're doing, and explain to us what they wanted. We went up there and two engineers were running the whole program. One man designed transformers and the other fellow did everything else. We were amazed that they could continue this way. So we asked them what their secret was. He said they really don't change the equipment at all. The only critical thing in the system as in most systems is the filters, which determine the selectivity and just how good the system is. He said he looks at GE literature, and when they change frequencies and bandwidths; he comes to us to make the filters. He said now they're changing them so rapidly, what he'd like us to do is come up with a design procedure so that when GE changes, he doesn't have to go to us, he just would look at charts that we have designed for him. And that's what we did. We came up with a whole set of charts so that they could design any filter they wanted. And they lasted that way, I don't know how many years after that. Eventually it just went kaput. It was a shame.

**Hochheiser**:

But meanwhile you're now back with Anatol in the Network Synthesis Department.

**Blinchikoff**:

Yes.

**Hochheiser**:

And you continued with that for several years?

**Blinchikoff**:

I continued there until 1963 when I received my Master's degree, going in the evening again.

## *Grad School and Helical Resonators*

**Hochheiser**:

What led you to decide that you wanted to continue past the Bachelor's to get your Master's at night?

**Blinchikoff**:

I did it because I wanted to further my education and to see if I could do it. I didn't do it for any monetary reason. That's just the way I was. I mean something's there and I'd like to try that. I can do that. Give it a try.

**Hochheiser**:

Anything particularly notable that you worked on with Anatol in this period?

**Blinchikoff**:

Oh yes. During that period there was an article published on helical resonators. These were resonators that were used in antennas for many years and this article described their design. Now, once you have a resonator, if you can just couple these resonators together, you've got a filter. That's really what filters are, resonators coupled together. Of course the trick is how do you couple them and how do you calculate the coupling and things of that sort. So in our group some people built these helical resonators, wound them, they were sort of hybrid between distributed and lump-constant networks. The resonators had a wire length slightly less than a quarter wavelength but they were wound like a coil and there was no connection at the top. It was a really weird type of [laughing] animal and people looked at it and said, "Well, where's this wire at the top connect." No it doesn't connect. It sits there. And after experiments in our lab which was right where our desks were, Anatol asked me if I would like to write an article on helical filters with him. So we did. And it was the first article published on realizing a filter with helical components. Can I ?

**Hochheiser**:

[Interposing] Yes, please. You can hold up the article.

**Blinchikoff**:

Westinghouse liked it so much that they decided to design a cover, we might have helped design it, and they put this booklet together. Our article is inside. They printed a whole bunch of them and they went pretty fast. [Chuckling]. On the back here it says Westinghouse Electric Corporation, Electronics Division, Network Synthesis Engineering. But there you see just what they look like, glamorized as best as we could do in those days. There's the coil sitting there and then the cover fits over top. The size of the shields inside determine the coupling. It still was, I would say, a cut-and-try proposition with the coupling because these kinds of things were very difficult to calculate. It's a lot of experimentation. But this filter covers a frequency range where lump-constant elements sort of fail, they become so small that you can't get the quality factor and this design fills in around 20 megacycles in those days to about 2 gigacycles. I'm very proud of that contribution because afterward everybody referred to that article as the beginning. And then they did their improvements as they went along and I think there was a book written on helical filters.

**Hochheiser**:

Where, where did you publish that?

**Blinchikoff**:

That's in the IRE Transactions on Components Parts, September, 1961. That was the first time we published in an IRE publication. Later the IRE merged with AIEE to become the IEEE.

During that time, people from the communication section came to us with a problem. Their customer wanted the Westinghouse transmitter to broadcast over a 1,200 foot antenna with very narrow bandwidth. To achieve this they wanted Westinghouse to broaden the antenna bandwidth. We were given the characteristics of the antenna which we simulated with a resistor and a capacitor. And it dawned on me that if I could design a filter incorporating those components as the filter termination, the filter wouldn't know where the components are coming from, the antenna looks like that, that's what the filter thinks it is. So I played around with that and wound up with a filter that had the required wide bandwidth. It wasn't a very complicated network. We built it and gave it to John Singel of the communication group. I remember that John came back a while later, weeks later, maybe a month and said that he had performed a very interesting

experiment. He took it to the antenna site. There were generals there and they wanted to see how the transmitted broadcast sounded with and without the filter connected. After the first experiment, a general said that's great. He said now show us how it works with the broadband signal. And John said it was broad-banded. That's how it sounds. The general couldn't believe that the broadcast was actually that good with broad-banding. Everybody was very happy. And Anatol said maybe we should write an article on this. So we did. We sent it in to the IEEE Communications Transaction. The reviewers came back with a very [chuckling] bad review. One person said he was an antenna expert and knew this particular tower and antenna. And he knew all the tricks for broad-banding and he couldn't broadband this antenna more than two times, whatever the number was. And we had done it. We of course wrote back that we did this and sent up supporting evidence and eventually they published the article in 1964. But I was always curious why these experts couldn't get it to work and we did. One day an engineer in the Communication section called me to his office. He said he had been doing some calculations with our broad-banding network. He asked if I knew that when our network is installed that a large current is generated at the input? I said no. I wasn't aware of that. We tested it on the bench. We did not consider high currents; we looked at the frequency response. He said the reason that it works and nobody else could get anything to work is because our transmitter is over-designed so when our network is inserted and draws this high current, our transmitter doesn't care. He said everybody's transmitter would burn up with this high current. So the network appears as a very low impedance at certain frequencies, but that was the situation and I'm pretty sure we mentioned that in the article. But anyway, as a result of that demonstration, Westinghouse received a good contract.

**Hochheiser**:

Is this the 487 L contract? Or is that something else? I see you mentioned that in the material you sent to me.

**Blinchikoff**:

Connected with the broad-banding or separate? I'm not sure.

**Hochheiser**:

If I can quote what you sent me. [Chuckling]

**Blinchikoff**:

Okay.

**Hochheiser**:

It said the ability to broadband antennas was a major factor for awarding the 487 L contract to Westinghouse.

**Blinchikoff**:

Well it must have been true because what's written there is not something that I just wrote. That's something that I've had for many years so at that time I knew what it was. But now going back and trying to piece together these acronyms..

**Hochheiser**:

Right, the acronyms and the numbers don't stick in your head. It's the work that sticks in your head.

**Blinchikoff**:

Yes. Certain acronyms do. Of course I know the acronym 487 L. Like I say if it's there then it's true because that was written at the time that it occurred when I wrote the biography.

**Hochheiser**:

I think we're probably about up to 1963 now.

**Blinchikoff**:

1963.

**Hochheiser**:

Okay. So you've now completed your?

**Blinchikoff**:

Master's degree

**Hochheiser**:

And what led you to decide to continue on from that towards a Doctorate?

**Blinchikoff**:

Well let me update my personal life. I married Nannette Clapman on June 17, 1962. On May 3rd, 1963 my first daughter Marlene was born. That June I received my Master's. And then I started thinking about going further, again to further my education and also basically just to do it. I knew it would be very tough, on top of being married with a child, I would have to spend at least one year full-time at the university. Of course, I talked this over with Nannette. I told her this is going to be horrendously difficult with respect to time, but she agreed that I should pursue the degree. She was supportive the entire time. I then talked it over with Anatol. We came up with a plan. I would try to get employment at the university to satisfy my residency and he would have it arranged with Westinghouse that I would be on an 8-hour a week schedule. Well, I went to Johns Hopkins and applied for enrollment in the Doctorate program. I was approved and also approved was employment at the Carlyle Barton Laboratory, which was a classified building on campus. They had an arrangement with the Air Force which was extremely beneficial to all. The Air Force designated three universities in the country; Stanford on the West Coast, Michigan in the Midwest and Hopkins on the East Coast to do their research. The laboratory at Hopkins had three stories and our floor was radar and radar countermeasures. Another floor was devoted to physics. And the other floor was communications-oriented, I believe. I don't remember exactly. Now the idea was that the research reports that we wrote, with just a change of covers and some modifications, would be our theses. And this was such a wonderful arrangement. Of course your thesis had to be related to the work that the Air Force is paying you to do. I thought I would go there and see a bunch of young guys. Let's see 1963, I was 29 now. Well there weren't many young folks. Most were my age and older; people who were able to get in this program and have an opportunity to have all their tuition paid by Hopkins and yet get paid while they were working. They showed me my office which was about 7 feet by 9 feet, with no windows and a very high ceiling. I always tell the joke that for the first two weeks there people came in and hung their coats until they found out that this was not the closet [Laughing].

**Hochheiser**:

[Laughing]

**Blinchikoff**:

But it felt like it. For the first month or two nobody said much to me. I didn't even know what was going on [chuckling] until I eventually started talking to people. They said to do what I wanted until I find something of interest. I made one big mistake. It's sort of humorous. Since we're revealing all of life's secrets, I was in the rest room and the director of our group was standing beside me and asked me how are things going?" I said they're going great. I just happened to come upon such and such. He told me that my work was great and that he was going to organize a seminar and I was to present my results at the seminar. I had this sick feeling; what have I just done? I left and nothing happened. He never came back to me. Then I realized, he's really not interested in this. You just do it. It's up to you to do what you want as long as it's beneficial to the Air Force. Coincidentally, the same meeting occurred maybe four or five months later. And he asked me the same question. Herman, how are things going? I said fine, sir, fine. And that was it. [Laughing]. Eventually you did have to report what you did but I learned a good lesson there; just answer the question, don't supply more than people want. [Laughing].

During that time I was taking courses at the university. And everybody understood. You stopped your work and went to class. About one year after I started, I had to take what were called Baby Orals. They want to find out where you stood. I remember that when I finished and they called me back in, they had mixed feelings. They told me that I had passed, that I seemed to know the subjects but I often missed their underlying connections in real life. They suggested, very, very strange at the time, that I have more bull sessions. That was it. I quickly realized after that what they meant and that proved to be an extremely valuable form of learning. You can think you understand something. You can go through the calculations but then realize, you do not really understand the physical process. Then you talk to somebody else. They have a different viewpoint. And finally the two of you get together and you start understanding what actually is happening. So I've always used this at work. Get together with some guys. Hey, this is what I think. What do you think? And you then realize that if you get three or four agreements it's probably correct or else you're all [laughing] down the tubes.

At some point I found the subject that I thought would be a good thesis topic, not realizing that I had picked an extremely difficult subject. What led me to that subject was an article in the IEEE Proceedings by Weiner and Leon at Purdue. They had published an article in 1965 called The Quasi-Stationary Response of Linear Systems to Modulated Waveforms. What this meant was, can we treat linear systems that are excited by a modulated signal as if the signal at each instant of time was a fixed frequency. If so, then we know how to calculate the response. This is the quasi-stationary response. If the frequencies cannot be considered constant, well then the

response calculation becomes much more difficult. The question is how fast can the frequency change before this fixed response is no longer valid. This was a subject that was looked at in the 1930's, 40's, and 50's. A lot of mathematicians took a cut at this problem and a closed- form solution seemed to be intractable. Weiner showed, that by the simple expedience of integration by parts, which is not a difficult operation if you know how to separate the integrand, he was able to express the total response as this quasi-stationary response and an error response. So one could calculate each response. It was a closed- form solution. Beautiful. I read that and I said gee, maybe I could extend that to time-varying networks. So I went to my adviser.

**Hochheiser**:

Who was?

**Blinchikoff**:

Dr. William Huggins. I was going to mention him. A gentleman of the first order and highly respected in electrical engineering. I took a course from him. He was the first person that I met who understood that the digital world was coming. This was in 1964, 1965. He had already written articles on digital processing. He used to run into class and tell us what he discovered that day. It was not a highly-structured course. He had devised his own notations for the digital world and he was ready to go. So I told him my idea, and he told me that he knew Don Weiner very well. He called. him while I was sitting there, told him what I'd proposed. Weiner said, well [laughing] that's a marvelous area of research. But he said it's not very easy. Dr. Huggins told me that and I said I would look at it. Well I quickly found that it wasn't easy and beyond a first order system there was no way in the world I was going to express this response in closed form. And Dr. Huggins said you don't have to express it in closed form. Get a special system.

**Hochheiser**:

Right.

**Blinchikoff**:

I found a special system; it's called a separable system, in which you could separate the time-varying portion from the fixed portion. I was able to come up with a separation after which a computer is required to approximate the remaining function as a sum of exponentials, but he said that's fine. Along the way I found some things that I didn't even realize were contributions. I would say it's almost a shortcoming of my awareness. I

would come up with things that I didn't think were very significant. I would just do it, put it on the side, and then later on I'd see where somebody else did it, got their name associated with it [laughing] but all this was too late for me. My time had passed. As a side note, a man by the name of Rhea published a book and he included in there something that I had published. He referenced it properly. In fact he called it the Blinchikoff filter which was sort of funny because it just felt good to hear my name associated with a filter. I happened to find an Internet website one day and somebody asked some advice on how to design certain higher-order filters. One of the responses was to go to the book that Anatol and I wrote. They're published there but only for certain orders, the higher orders aren't there. Now Rhea again, responded and starts talking about what we did. He said that's the Blinchikoff filter and he said first of all, let me emphasize that Blinchikoff didn't call it that, he's too modest for that. Rhea called it that because that's the way he identified it. He said the thing that yields a symmetric response was the fact that such and such occurred and it is known as Carassa's rule. And I'm reading all this, I said Carassa's rule? I did a similar analysis and it is in our book well before his publication, but he just didn't see it. So, here's a guy that got his name associated with it. But most original information is transmitted through the journals and papers. It's not the books. I have stuff in the book that preceded what people did in the journals. But again I didn't think they were that significant to publish separately at the time. But others did. And anyway how did we get onto that?

**Hochheiser**:

You were talking about your dissertation.

**Blinchikoff**:

Oh right. There were things in there that Dr. Huggins picked up. He said all these are contributions and we're going to make sure that the Board knows it.

So he outlined things, [chuckling] I would have never known were contributions. And eventually he decided that I had done enough.

**Hochheiser**:

Right. So you wrote it up and got your Doctorate.

**Blinchikoff**:

Yes, whenever he edited my work he would use a red pen and he would always preface it by saying he was really sorry to mark it up like this. He just felt bad that he had to mark it. Well, I said fine. That's what I want you to do. But anyway, he wrote his recommendation for the degree. I took the final oral defense and passed, thank goodness, and that was October of '68. So I was there at Hopkins five years. Oh, he and I then published the dissertation as an article in the Franklin Institute Journal.

**Hochheiser**:

Now did you remain nominally on the Westinghouse payroll?

**Blinchikoff**:

Yes.

**Hochheiser**:

That 8-hour arrangement worked?

**Blinchikoff**:

Yes, I had told this to Dr. Hamburger who was in charge of the lab. But interestingly, he had two hats. When he left the lab, he put on another hat, and he was in charge of the electrical engineering department. He kept the two roles separate. I went to him one day and I told him that Westinghouse pays me a salary for one day a week. He said well, you can't actually be there. I told him that right now I didn't have to. But then later Anatol said I had to come in one day per week. So I went back to Dr. Hamburger and told him that I'm supposed to go in one day. He said, well I don't think I can let you do that. I said well let me go back and check the rules. Actually I think I checked them first, and it said that lab staff is allowed to consult one day a week. I told Dr. Hamburger that the rules say that we are allowed to consult one day a week and since I'm going over there one day a week that should count as consultation. He said let me look that up. He was a very straightforward man. He looked it up, said I was right, and allowed me to do it. I respected him very much. There were no ifs, ands, or buts. He had no problem not knowing something and having somebody point it out to him. He was a terrific man, a true gentleman of high integrity. They wound up making him head of the Hopkins Bicentennial celebration after he retired and named the archives after him.

**Hochheiser**:

So you finish your dissertation, get your Doctorate and then you go back full time to Westinghouse?

**Blinchikoff**:

Yes. I investigated a few places to see what employment was available, but I knew in my heart that I was going back there, that's where I liked it. I loved it there. It was great. [Laughing] I wasn't about to leave.

**Hochheiser**:

Yes, a good place to work.

**Blinchikoff**:

Wonderful place. The people at Westinghouse; the biggest enjoyment at Westinghouse were the people. How they were on the outside, I don't know, but inside, at least in our section, it was just one big family. I do remember coming back and my salary was $16,000 in 1968 with a Ph.D. That was it. And there wasn't really much more out there. I might have gotten a little bit more elsewhere but it wasn't worth it to me. I mention that just to show what salaries have jumped to.

**Hochheiser**:

Of course you have to think what things cost in 1968 —

**Blinchikoff**:

Yes sure, yes. But that wasn't a whole lot of money then for a Ph.D. Again it was a good living [Laughing]. That's what Nick Petrou told me. [Laughing]

**Hochheiser**:

Exactly. So you came back the end of '68.

**Blinchikoff**:

Yes.

Technological Change

**Hochheiser**:

And I assume you now had a new position after five years and a Ph.D?

**Blinchikoff**:

Yes I became a Fellow Engineer. There was a sense in the air that the filter work was not going to be as abundant as it used to be. And why is that? Well there are a few reasons. One, digital processing now was starting to take hold. And people were looking to realize filters, where possible, digitally.

**Hochheiser**:

Right, rather that the analog tradition you had been doing.

**Blinchikoff**:

Yes. Two, work in the communication section at Westinghouse was decreasing and they had been an extremely good customer for filters. During that time, I did some phase-lock-loop work for them and that resulted in an article with George Vaughan that was published in '81 and a patent. And what's the third reason? Oh. People, rather than come to the filter group, were buying them outside. By now more filter companies existed, and the computer was a big part of the design. The old image parameter theory that we were raised on, which was part art, had given way to Sidney Darlington's exact synthesis procedure, and people had published tables of the element values for the famous responses such as the Butterworth and Chebyshev. This approach allowed the theoretic response to be achieved without any approximations, as was necessary for the image parameter approach. Of course the realized element values were lossy, but for the low-loss case, non-specialists were able to design their own filters or at least come very close. Even in the 50's Milton Dishal had published coupling values for filter resonators. It took a while for this approach to catch on. Anatol took a while before he would change. He was stuck in the old ways and being close to him I was too. It took a while for us to change. Now you input the desired response to the computer and it outputs everything; schematic, element values, and time and frequency responses. A lot of the romance is gone. It's a shame.

**Hochheiser**:

[Interposing] Or perhaps the romance has moved on to other areas.

**Blinchikoff**:

That could be. That could be. But I was beginning to feel the change from an engineering atmosphere to a business atmosphere. Even though I always knew that the goal of the company was to make money. I got a rude awakening to that one day, when I went into another boss's office and he said close the door. And I closed the door and behind the door was a poster. It must have been 5 feet tall and 3 feet wide and it showed a big dollar sign and said Our Business is to Make Money.

**Hochheiser**:

And about when was this?

**Blinchikoff**:

That's in the 70's.

**Hochheiser**:

So you see this change already in the 70's.

**Blinchikoff**:

Yes. The filter work was slowly decreasing, but there were still filter designers in our section. During this time I got interested in signal coding, beginning with the binary codes. I showed how to optimally reduce sidelobes in the signal's compressed pulse and this analysis is included in our book. Five years after the book's publication somebody published an article on exactly the same topic. There was, however, a brief 2-week interval in 1969 where we really were on the front line.

**Hochheiser**:

Okay so shortly after you came back.

**Blinchikoff**:

Yes it would have to be. Westinghouse by that time consisted of the East Building, the West Building and the Central Building. The Central Building contained the computing facilities, cafeteria, library, and top management. The East Building was devoted to airplane radars, while our West Building dealt with ground-based surveillance radars.

One day people from the lunar camera section at the East Building came to us and said they had a problem. Apollo 12 was going to land on the moon in a few weeks and they were having interference problems. The astronauts are fitted with sensors that compute their heart rate, their blood pressure, and other physical items. The data was sent to earth but this data was interfering with the picture from the lunar TV camera. They said there is no time to do any long-term studies on a solution to this problem. They needed a quick fix. They needed a notch filter, something to eliminate these frequencies in this narrow band, but it had to have the additional property that its time-domain response should have low overshoots and ripples because they cause inter-symbol interference. Well, such a design was not in the literature but I had a design, again, one of these side analyses. It was the design procedure for a low-transient notch filter that I later published in the IEEE Transactions on Circuit Theory. I talked to one of my colleagues, his nickname is Yogi, his name is Mayer Savetman. I gave him the design and he put it on the computer. He came back and said it worked. I said okay, let's put it together. It wasn't a complicated structure and the measured response matched the computed response. We handed it to them literally days later. They went back to the East building; they hooked it up. They said great! Great improvement! Really great! They then asked us to go to Houston and let them try it on the complete mockup that was there. Now this filter was not going to the moon. It would sit on the ground to filter what's coming from the moon. So off we went to Houston. We walked in there and they had this whole mockup; it was amazing. They hooked it up. They said great! This is really great! [laughter] We felt so good. I said, are you going to use it? We're going to decide on that. But right now, it looks like we're going to use it. So we left it there and came back. That was it. . The landing was supposed to be early in the morning, I remember, about six o'clock in the morning. We now had two more daughters, Laurie (born in 1964) and Cari (born in 1967) and our whole family was in our den. I had people from our section there. Yogi was there. We were sitting there and the module lands. The TV picture from the moon comes on. Beautiful. [claps] Black. That was the landing where the camera was pointed to the sun.

**Hochheiser**:

[laughter]

**Blinchikoff**:

The camera failed.

**Hochheiser**:

Your filter worked but the camera failed.

**Blinchikoff**:

Our filter worked in Houston as far as we knew. Of course we were disappointed. We went to work and found out that at the last minute they decided not to use it, not that it had anything to do with the failure. It always disturbed me why they wouldn't have at least hooked it up, tried it, see if they got the improvement they wanted. If they didn't, switch it out. Why would they just not use it? It's not a complicated situation. But anyway, that was our two weeks on the front lines. [laughter]

**Hochheiser**:

Now through the 70s you continued to work on filter design?

**Blinchikoff**:

Yes, but I would move into different areas.

**Hochheiser**:

Such as?

**Blinchikoff**:

Let me just explain that now Anatol was no longer the manager. By the time I came back to work after my doctorate, he had been moved off to the side. His personality and his way of doing things just didn't fit in with the new modern culture. So he was made an advisory engineer. I'm sorry, a consultant engineer, which is the highest level of engineer at Westinghouse.

**Hochheiser**:

Right, the highest level non-supervisory position.

**Blinchikoff**:

Correct. Even though he had been a section manager. But now they moved him off and Dick Morrison, who always was the acting supervisor of our group was now the supervisor of the filter group, which was now part of a much bigger section called

Equipment Design. So at this point, the manager of equipment design suggested that I ought to branch out. He could also see that the filter area—

**Hochheiser**:

[interposing] Who was he?

**Blinchikoff**:

His name is Dick Linder He eventually became president of the Westinghouse Baltimore Divisions. So we tried that, and I got involved in the more general aspects of radars themselves. His suggestion was very valuable as I later joined the System Engineering section. But in the process I was still involved in components. Equipment Design had a contract with RADC to, among other tasks, examine the area of pulse forming networks, in particular, realization of a network whose output was a rectangular pulse with adjustable pulse widths. So I worked on that problem and came up with a scheme whereby you could achieve this. The head of this contract, Bob Gardenghi, and I wrote a paper on that. He presented the paper at the conference because it was a power engineering conference. I didn't feel comfortable presenting in that environment because I was more into the circuit design. But anyway, that was a diversion at that time. From your notes there, because from that point on until about '79, I do not remember any specifics. Just mention some things.

**Hochheiser**:

Design and synthesis of low transient crystal filter, for which you received a patent.

**Blinchikoff**:

Yes, well, I'm just trying to think what year that was.

**Hochheiser**:

Well sometime in the 70s.

**Blinchikoff**:

Yeah, well these are things that I just did, not for any particular job, I just did them, often working on them at home. Like I say, I did these things with the knowledge or hope that when the time came, it would be available. I often worked on whatever interested me at

the time. So some had nothing to do with a particular job. That one I know had nothing to do with a job at the time

**Hochheiser**:

Pulse forming networks?

**Blinchikoff**:

That's what I just mentioned.

**Hochheiser**:

Phase lock tracking filters?

**Blinchikoff**:

Yes. There was a request at that time from George Vaughan, a nice person and a very good engineer in the Communication section. They had a frequency-agile system that required a phase-lock loop to track the frequency. This application required a much higher-order system than was thought to be practical. Again, another interesting advance. Phase-lock loops usually are confined to first-order and second-order systems. Well again, because of my background I always tried to fit the requirement into the filter concept because I always felt that all these things were really disguised filters. In reality, they were; they just had different names. I once assembled a list of many different devices that are used in electronics. All were described by the filtering mathematics, but they did not have “filter” in their name. So I applied the filter concept to these phase-lock loops and designed each section according to a filter configuration so that when you put them all together the loop yielded the desired filter characteristics. There were practical problems about this loop that had to be addressed and George ably solved them. We submitted a disclosure on this work and it was rejected by reviewers in the East Building It turned out there was a political dispute between the East Building and our building in the phase lock- loop area. We got word from another engineer who had problems with them to resubmit it. He would make sure it got through because it was new and a valuable contribution. So we resubmitted it and it was approved as disclosure and recommended for a patent. The patent was rejected. We included about 15 claims, all of them were rejected, rebutted, came back rejected. They said if we could include a configuration that had not been published, a patent would be granted but without all of the claims. I remember George saying, we're going to fight this to the end. I told George to give me a little time and I'll come up with a configuration that will do the job and

make them happy and it'll be accepted. Don't worry that we're losing the battle. The fact is, we're getting a patent for this work. That's the goal for us and Westinghouse. I came up with one relatively simple schematic, we sent it back, and a patent was granted.

The review process of articles, disclosures, and patents may involve politics, egos, and incompetence; that is, the reviewer may not be particularly versed in the details of that subject. I found myself, when I was reviewing an article, that if it was somewhat out of my real knowledge, and I couldn't quite get the gist of it, I would send it back saying that I was not qualified to review it. But when the article was right on target for me, I often could provide suggestions to improve it. So you have to be fortunate in who's reviewing your submission. But that's the present process, it's ongoing, and I don't think it is going to change much.

**Hochheiser**:

Now, besides the lunar camera, did any of the things you worked on during the 70s lead directly into larger products and systems at Westinghouse? Or are you even aware of it?

**Blinchikoff**:

No. I can't think of any. Most of my work during this time was analysis. Most of it was analysis after—

**Hochheiser**:

[interposing] Analysis of what?

Systems Engineering
**Blinchikoff**:

Let me first say that 1979 was a turning point in my career. At that time, there just wasn't much for me in the filter area. Not that all the work was done, I'm talking about work coming in that had to be done. I therefore decided to move upstairs to the second floor, which was Systems Engineering. This group was concerned with the overall system and derived the allocations to the various equipment groups, such as the transmitter, receiver, display, and signal processing. So it took me a while to get into the flow of systems engineering.

**Hochheiser**:

That, quite a change from what you've done.

**Blinchikoff**:

Yes. It really was. And I wasn't really sure I belonged there. But it turned out that there were things there that fit right into my category. For example, the group had research money for examining radar signals, finding suitable signals, most notably, non-linear FM signals. Analysis of linear FM was published by Darlington and we have talked about that. But not much was published about non-linear FM because it was difficult to obtain general results. Let me just point out its advantage. With linear FM, the compressed pulse had side lobes that were only 13 db down from the peak. So the sidelobes were reduced by adding another network called a sidelobe-reducing filter. Sidelobe reduction of biphase codes was one of the areas I had put in our book, which I said somebody then published five years later. But that was an effort to find the filter that minimized those peaks, the side lobe peaks. Now, if we could design a nonlinear FM signal that inherently had lower side lobes in the compressed pulse, we would not need a sidelobe-reducing filter. This added filter results in mismatch loss which reduces the signal-to-noise ratio and that's very bad. You would like to avoid that. But you had to do it with linear FM. So we worked a long time on generating suitable non-linear FM signals and they were used in some of the radars. I know we designed one for the next modification of the AWACS. I'm a little hazy there since I left a short while later. But one was incorporated in the ARSR-4 radar. There may have been other radars…I'm not sure.

**Hochheiser**:

That's okay.

**Blinchikoff**:

But I know it's used. But anyway, it was quite an effort in that area. John Taylor, a Consultant Engineer who was one of the top engineers in the West Building, had come up with a radar signal called the quadriphase code. This is a code that has four phases as opposed to a biphase code and it has some very significant advantages. But it's obviously more complicated with four phases. I had a lot of fun doing a pretty thorough analysis of the code It was John's code; I did the analysis of it. One day we saw an article by the Chinese discussing the code. They didn’t go into the depth that we had. I told John that we ought to publish our results. I mean, why give them the credit? He was always reluctant to publish anything about the code because it was advantageous for Westinghouse to keep the information in-house. I said, but it's out now and he agreed. So we wrote an article; it's in the 1988 Transactions on Aerospace and Electronics. It was

also accepted as a paper for a radar conference in London and John suggested that I present it. I thanked him of course. I took my wife with me and presented the paper. Very bad period financially. It was October 1987 when the whole market crashed. [laughter] So some people blamed me. So that's the kind of things I was doing at that time.

In 1982, I was put on the Nexrad proposal. It was the next generation weather radar. I moved to a satellite building called the Airport Plaza which is up the road from here. That was my first time being involved in the actual system analysis of a radar at the proposal level. I found it terrific; I really enjoyed it because I had never been in the arena, so to speak. I was always doing my thing. Occasionally I'd contact the customer and talk to him when he came in. But here I was really in the arena. I enjoyed it, it was very good. We took several trips to Colorado Springs for the company.

**Hochheiser**:

You said you went out to Colorado?

**Blinchikoff**:

Yes, I went to Colorado Springs with Harold Ausfresser, the proposal system engineering manager, to attend a weather-radar conference to learn more about the subject. We were in cahoots with Ford Aerospace, located in Colorado Springs. They were the top dog, we were the radar. We again went to Colorado Springs to submit our contribution and work with them. Unfortunately they made a very bad money estimate of the cost and the customers didn't like it so Ford reduced it by a large amount and I think that destroyed their credibility. Why would they submit this higher amount and then at the request of the customer, reduce it drastically? There may have been other things involved. But we were told that our radar presentation was excellent. They liked the radar but we didn't get the job. Now I see where the Nexrad is in operation. I remember at the time one of the people on the proposal had a map of the United States and put a little red flag every place that these radars were going to be installed, something like 169 of them around the country. They were lined up on each side of the Rockies, right down the east and west coasts. It really formed a nice pattern. It was a very enjoyable experience and I learned a lot. Nexrad was opposite from our other radars. The other radars,were trying to get rid of the weather. Here we were trying to find it. [laughter] There used to be interesting discussions among the system designers.

**Hochheiser**:

But ultimately, Westinghouse did not receive the contract?

**Blinchikoff**:

Yes, we did not receive the contract. But since I was over there… They were just starting up on the ASR-9 radar, which we had won. I was not on the proposal team but I might have contributed to it. I probably did but I have forgotten by now. People would often ask me to do something, I'd do it and then find out they used that. Which was fine. I was happy and they were happy. Then I got involved with the ASR-9 and this was the first time I had actually been on a Westinghouse job at a level where I could see more than just my little niche. A big issue on this radar was the system stability and I spent a lot of time analyzing it and discussing the results with the customer. It was very rewarding, especially when it finally got built. I can now drive down the road leading to the airport here and look over to the right and see the orange antenna still spinning around, which I point out to my wife every time we pass it. This radar has a range of 60 miles. After the ASR-9 we received the contract for the ARSR-4 radar, which is the Air Route Surveillance Radar, with a range of 250 miles. One of them is someplace in Virginia.

**Hochheiser**:

Right, so this is a little later?

**Blinchikoff**:

This is right afterward.

**Hochheiser**:

So one contract—

**Blinchikoff**:

[interposing] ended.

**Hochheiser**:

The ASR-9 led into the ARSR-4?

**Blinchikoff**:

Yeah. That's correct.

**Hochheiser**:

Yeah. Now is that A for Air Force?

**Blinchikoff**:

No. The ASR was Airport Surveillance Radar. ARSR was Air Route Surveillance Radar. The ARSR-4 tracks the plane from 250 miles to 60 miles, then the ASR-9 tracks it to the airport

**Hochheiser**:

Do you know who the customer was?

**Blinchikoff**:

Well yes, the ASR-9 was the FAA. The ARSR- 4 was the FAA and a military unit.

**Hochheiser**:

Together?

**Blinchikoff**:

Yes I never quite knew what the add-on was for the military.

**Hochheiser**:

Ah.

**Blinchikoff**:

But it was long range so you can imagine the military would have an interest.

**Hochheiser**:

That's what I was getting at. I know there's certainly FAA civilian aircraft radar systems.

**Blinchikoff**:

Yes.

**Hochheiser**:

And there are military systems, and that's what I was asking. Where did this fall?

**Blinchikoff**:

The ASR-9 was strictly FAA. I had many, many interactions with the customer. Very nice people. I received some patents as a result of work done for these radars but I don't think there were any articles published from them. We did receive some disclosure awards. I have listed them but I don't remember the topics. I should point out that I was promoted to Advisory Engineer in 1986. So the ARSR-4 wound down around 1992, beginning of '92. And then I started feeling that Westinghouse was not going to be around very long. There were murmurs in the air. Having a CEO (Michael Jordan) who used to be CEO at Pepsi-Cola was not very encouraging. Pepsi-Cola and Westinghouse didn't mix. He had his sights on Westinghouse becoming a, not a communication company, maybe that's a good word, media company or whatever.

## *Changing of the Westinghouse Guard*

**Hochheiser**:

Right. Broadcasting.

**Blinchikoff**:

Broadcasting. We wound up buying CBS and then CBS bought us. Now our retirement's under CBS with a special Westinghouse category. But anyway, after being on these two perfectly wonderful jobs interacting with a lot of interesting people, having fun, performing a lot of analysis, gaining a lot of education, I was sort of thrust out and told to look around. See if you can find something. Well I said, I'm not supposed to look around and find something. You're the manager, you're supposed to find it for me, that's what you do. He told me to see what I could find. [laughter] I said, I don't know how to find a job. What do I do? Walk around and say, can you employ me? So they found things for me and they were temporary. They were short-term jobs, which while educational, were not rewarding. It was just too fast.

Finally opportunities came. There were lay-offs coming up and I went to the manager and told him that he could lay me off. A year earlier I wouldn't have done that in a million years. There used to be a stigma attached to being laid-off. But I watched others volunteering to be laid off and they got terrific benefits. My job just wasn't the same anymore. It just wasn't the same. What I was doing was not enjoyable. For forty years, everything was enjoyable. I mean, sure you had bad days, stress days. But overall, extremely enjoyable time. So he approved the layoff. I told my manager that my lay-off makes his job easier; it's one less person that he has to lay off. Somebody that needs a job can have it. My manager called me a couple days later and said, the big boss said that I'm not to be laid off. I won't mention his name. I told my manager to please go back and tell him that I requested it. He went back and the big boss said, are you sure that's what I said. My manager said, yeah, that's what he told me. So officially I got laid-off, my last day was Dec. 31, 1992 But it was not uncommon in those days to do that. Three years later the company was sold to Northrop Grumman.

**Hochheiser**:

Right.

**Blinchikoff**:

Not that it's bad but just change.

**Hochheiser**:

Yes.

**Blinchikoff**:

During the period, 1969 to 1992, I taught courses at the Westinghouse School for Applied Science. The first started out with three of us teaching a course on filtering but after a few years the other two decided they didn't want to do it anymore. So I took it over and taught it until 1992. In the early 1970's Anatol came to me, this is after he had been moved off to the side, so to speak. He said Wiley called him and said they would like him to write another book. He already had one book published by Wiley. All of us helped out with that book. It's a classic; it's called Handbook of Filter Synthesis. He asked me if I would co-author a book with him. I talked it over with my wife, Nannette. I said this is going to be a time-consuming job, but it's an opportunity I don't think I'll get again, where a company actually wants us to write a book. She agreed that I should do it and I told Anatol that I would. I took much of the material from my filter course and

work that I had done over the years. Anatol had contributions from other areas and we put it together. When he would hand me material, I'd have to smooth the writing and arrange it in a more readable fashion, as well as incorporate my own ideas. As long I was very familiar with the subject, I had no problem with that arrangement, but then he handed me a chapter that was outside my comfort range. I remember starting on it and saying this is not going to work. I have to do too much research to do this and that's not the way to write a book. I want to write a book on things that I've digested a hundred times. I said that's it, Anatol. That's the end. [laughter] The result is sitting there.

**Hochheiser**:

Do you want to hold it up for the camera?

**Blinchikoff**:

Yes. Filtering in the Time and Frequency Domains. This is the original publication, the 1976 printing by John Wiley and Company, a very famous technical book publisher. In1986 they told me that sales were dropping off and they were not going to print it anymore. They sold the rights to a company called Krieger, who sent me a notice and said that if I'd like to correct anything they will make corrections and publish it. So I made the corrections and they published it in 1987. And then they sold the rights to a company called Noble. This company was owned by Rhea who I was talking about earlier. He published it in 2001 and then he sold the company to SciTech Publishing in 2006. They now publish our book. Not many people are buying it but it's there to be bought. Our book was written with the idea that it should outlast hardware. In other words, it's not hardware specific so no matter how the hardware changes, everything in there is still valid. So in that sense, it's good forever, unless Congress challenges the Fourier Transform. [laughter] The second course that I taught at Westinghouse was Radar Pulse Compression Signals from 1982 to 1992. The text for this course was a hefty report that I had compiled.

**Hochheiser**:

Okay, there's a few more things, but we do need to change the tape again. Okay whenever you're ready to start again—

**Blinchikoff**:

Well let me just see here. Well I could go back in time, does that work now or not?

**Hochheiser**:

The only constraint is that we have a limited amount of time left, maybe 10, 15 minutes left.

**Blinchikoff**:

Okay. Then that's not important.

**Hochheiser**:

Well first, one last thing. I know you brought your band pass filter slide rule. Why don't you show it to us and tell us a bit about it.

**Blinchikoff**:

Okay [chuckling] Well the first thing you have to realize is that we're talking about the time period,1957, 1958. There was not much on the computers as far as filter design programs, if any. And many of the design procedures at that time were constructed in the form of nomographs. Nomographs are scales on a sheet of paper on which you connect certain parameters with a straight edge and the intersection with a third line determines the parameter you're trying to calculate. It basically replaces calculation by a graphical method. Well it dawned on me that I could obtain the same results with a slide rule, a special purpose slide rule. Starting with the filter equations, I laid out the proper logarithmic scales on the slide rule so that one could easily determine the frequency response and insertion loss. This is the result of the commercial version that Westinghouse constructed in which you could line up various, well I'll call them parameters, move the cursor to read the results, and design your filter that way. You actually could create the response. This is not a calculation of the component values but the response. Westinghouse thought enough of it that they had 1,000 of them manufactured and advertised in a magazine, the first 1,000 respondents will get one free. And they were out of the 1,000 so fast that they decided they're not doing any more because they also would go fast and then they'd keep reproducing these things. [Laughter] The distribution, of course, was good publicity for Westinghouse. Anatol and I wrote an article about this slide rule. It contained a printed version that the reader could cut out and construct the slide rule. Although this was not the primary reason, the Westinghouse reputation in the filter area was very, very good. Also, the Westinghouse reputation in the radar field was A Number One. We never realized that while working because we had no comparison. But when going to outside conferences and talking to people, they're very well aware of the radars from Westinghouse and their high quality.

A lot of them knew people within Westinghouse and rate them as topnotch engineers. So I was always very proud to work at Westinghouse. It disturbs me and most retirees no end that there is no longer Westinghouse. They just cannot believe that such a company could be treated that way. It's a shame but life moves on.

## *A Lifetime in IEEE*

**Hochheiser**:

Yes. To change gears a bit I know you're a Life Senior Member of IEEE.

**Blinchikoff**:

Yes.

**Hochheiser**

And can you tell me a bit about the way IEEE over the years fit into your career activities and the ways if any in which you were involved with IEEE activities?

**Blinchikoff**:

I've been a member of IEEE since, gosh I don't know when I started. '59?

**Hochheiser**:

That's what the IEEE records say.

**Blinchikoff**:

Is that right? Okay.

**Hochheiser**:

Yes, though I've known times that the records were wrong— it gives '59 as the date you joined.

**Blinchikoff**:

Yes. That seems reasonable because prior to that, I probably was not too interested in the technical journals. I was going to school. I was working. But anyway, being in the filter area I was approached by some people who wanted to start a professional group here on circuit theory. We did but it didn't last very long. For what reason I don't know. I think I was the secretary or the treasurer, but it didn't last very long. Re-thinking my joining the IEEE, it must have been 1957 because I have The Proceedings from 1957 to now. I became a Senior Member in 1959. I still get The Proceedings although I must admit the content has changed so much over the years that I have little interest in most of the content. It used to be they had design examples, more specific things, things you could relate to. For better or worse there are few equations any more in the Proceedings. I think that's been delegated to the Transactions. As far as the outlet for design, they are the avenue.

**Hochheiser**:

So you published in IEEE Transactions?

**Blinchikoff**:

Oh sure. I never published an article in the Proceedings, everything was in the Transactions and other magazines. Component Parts, Communications, Aerospace and Electronics, Information Theory. After I retired I finished an article on the quadriphase code with sidelobe reduction, that used the biphase- code methods [Chuckling]. Of course I referenced the section in our book that described the sidelobe-reduction technique used on the biphase code. Readers could then see that it preceded the published information in the journal[Laughter]. This was a secondary motive to finish the article. Not that there is anything wrong with that.

**Hochheiser**:

[Interposing] It's there in your book.

**Blinchikoff**:

Yes. The biphase-code analysis is there and I wanted people to know that. Let's see what else with the IEEE.

**Hochheiser**:

Did you give papers at conferences?

**Blinchikoff**:

Yes I did. Some were IEEE conferences. The 1972 filter conference in Santa Monica may have been. Yogi and I went there and I presented the paper on the wide-band filters that I'd mentioned earlier and the one that Rhea had commented on. Bob Gardenghi, the co-author of our paper on the pulse forming networks, presented it at the 1978 Pulse Power Modulator Symposium. I previously mentioned the 1987 International Radar Conference in London. I gave a paper at Boston for the IEEE section meeting there. The head of the group there was a well-known engineer, Brookner, Eli Brookner. He had asked me to give the paper based on our London presentation. That's all I can think of for the IEEE but without the IEEE I don't think there would be much EE information disseminated [Laughter]. [Interposing] I mean look at the large number of transactions. And plus the website, being able to look at all the Transactions and Proceedings online is unbelievable. When I was younger, I would see in various publications that somebody was retiring and wanted to contribute his collection of IEEE magazines or the Proceedings. And they were gobbled up so fast.

**Hochheiser**:

Yes. Now there's really no market for it because what people want is to look at it right on their screen, not to have the physical—

**Blinchikoff**:

[Interposing] Then what do I do with mine? I can't throw them out.

**Hochheiser**:

No, but you're right that now people want it online. In what ways have you kept active since your retirement in '92?

**Blinchikoff**:

You mean intellectually or athletically?

**Hochheiser**:

However you want to answer the question.

## *Retirement and a Second Career in Teaching*

**Blinchikoff**:

Okay. As soon as I retired, my first thought was to go to schools and volunteer my service as a tutor. So I went to different high schools and they said they don't need me. They have our own teachers for tutoring. Well fine. So I went to Catonsville Community College, no I went to UMBC first, University of Maryland Baltimore County. For two years I taught a course on basic electric circuit theory. That worked out fine but then they told me that I was no longer needed. Any time you're an adjunct faculty, you're at the department's whim. I tried to convince them to allow me to teach a course based on my book but they said no. We don't want to create a new course.

**Hochheiser**:

Right.

**Blinchikoff**:

So I went to the community college in Catonsville. And I said I'll teach math, any kind of math you have. And they directed me to the head of the science department. It was math and physics. And he asked if I would mind teaching what they called a remedial course. I said I don't know what that is.

I said do you have a textbook. Well, he gave me the textbook. And I couldn't believe what I was looking at. I said this is for college students? Yes. I said I think this is more like junior high. He said, yes it is. [Laughter] I said let me ask you a question. How do these people get from high school to here? He said that he did not want to get involved in that subject. [Laughter] He said, if you would like to teach it, teach it. So I start teaching it. And I did that continuously since 1995, finally deciding at some point that I could no longer teach the lower level courses. I just didn't feel right teaching fractions at this level. So now I teach the highest level algebra remedial course, now called a developmental course. And I found a perfect fit. I teach it three hours Saturday morning at a satellite campus that is four miles from my home. Good group of people in the morning. So I'm very content doing that. At one point Northrop Grumman asked me to come back for a while so I went to Sykesville and did work for them there. But their contract with me ran out. And that consulting job ended. But the teaching keeps my brain active. I also tutor math for 3 hours on Friday mornings at the same location. Plus I am always available for tutoring my grandchildren and I have done so when asked.

**Hochheiser**:

That's good.

**Blinchikoff**:

I've always been very physically active. I've been competing in the Maryland Senior Olympics since I turned 55 which is '89, until now. One of my great enjoyments was having my father and wife participating with me in the same Olympics, in different age groups, of course. I've run just about all my life and continue to run now. I now picked up something new, the pentathlon, that includes five different events. It's age-group categorized and there's not many people 76 years old doing that so that's good. [Laughter] And I enjoy it. It's a lot of fun. But anyway it keeps me going.

**Hochheiser**:

Looking back, how would you characterize your career as a whole? We went through lots of specifics.

**Blinchikoff**:

I'll summarize it in a sentence.

**Hochheiser**:

Please.

**Blinchikoff**:

I have no regrets.

**Hochheiser**:

That's wonderful.

**Blinchikoff**:

I will add a little caveat to that, but I don't think it's a major regret and that is I should have been more aware that things I was doing were of value to be published. I realized that the other people thought they were valued judging by the fact that they were

published, if that's some indication. I could have had a lot more things published. But that's what I did. We did the book, that's the big accomplishment. But still those other things would have been nice but that's a minor regret. But in general, no, Westinghouse was great for me. I think I helped them. The company thought enough of my work to give me four Westinghouse Signature Awards. I am sure that I did work for most of the radars in our division. Like I say a fine group of people, other companies have fine groups too, I'm sure they do. But the people, the specific groups; the network group and the ASR-9 and the ARSR-4 groups were fun. Anatol was one of the funniest men unintentionally you ever met. I used to watch his secretary outside his office. She was laughing all day. She could hear what was going on in the office. He talked very loudly and we could hear some of it also. We had section picnics at his house, cookouts all the time. It was just a lot of fun. In fact a good sign of the times were the Westinghouse events. Westinghouse had something called Super Saturday. Families were invited over to the ATL facility. Food, games, running events for the family. They still have Family Day at Northrop Grumman. They used to have dances and bull roasts. I played on the basketball and softball teams. All sorts of things for the benefit of the employees. But over time they were eliminated. So new people coming in never knew about that. But you could see things were changing. You can say they're minor but that's just a sign of the times. I still say that there was a certain romance in the early days. It's very hard to define but I looked forward to going to work. Right? Just looked forward to going to work. So when you say how would I characterize my career, I have no regrets. And I've told my children that.

**Hochheiser**:

That's good.

**Blinchikoff**:

Every time that you have to make a decision, take a look at the information you have. Is it good information? Yes. Then make a decision.

That's it. You can't do any better than that. You don't have time to wait and see, well would this have worked. So, have no regrets is a great philosophy, I think. How many of us can say that? I don't know. They're always looking back sort of like the guy on the corner, he's standing there and the guy next to him is smoking cigarettes. He said how long have you been smoking cigarettes? He said, I've been smoking cigarettes for 50 years. 50 years? He said my god, mister, you realize how much money you could have saved? And he calculates it. He said with that kind of savings you could own that

building over there. He said to the guy, do you smoke? He said no. He said do you own that building? He said no. He said well I do. Okay. [Laughter]. I have no regrets.

**Hochheiser**:

That's wonderful. Well I started out with these cards. They're all face down now so I think we're finished. I thank you very much for sharing your recollections.

**Blinchikoff**:

Well I say you're welcome and I enjoyed it very, very much. And the time went so fast I can't believe it's over. Oh one more thing.

**Blinchikoff**:

One of the first things I missed when I retired was being able to talk to people every day.. In other words, if I was watching a ball game at home or I saw something political that was debatable, I could go in the next day, talk to people, and discuss things. At home, that's not possible. I have to call somebody and make arrangements for lunch. Much of the time it's not worth the trouble. It worked in the beginning with my wife but she's had enough of hearing the same thing over and over. [Laughter]. But thank you again. It's a privilege.

**Hochheiser**:

My pleasure.

**Addendum**

I wish to mention that on February 1, 1983 Anatol Zverev died suddenly of a heart attack while watching Mstislav Rostropovich conduct the National Symphony Orchestra at the Kennedy Center in Washington. He had retired from Westinghouse a few years earlier. He was my close friend and colleague and greatly shaped my career. For this I shall be ever grateful.

By retiring on January 1, 1993, I was able to fully participate in one of the great joys of life: grandfathering. My first granddaughter, Samantha Vallejo (Jack and Marlene) was born January 22, 1993; the second granddaughter, Dara Kramer (Jon and Cari) was born December 7, 1993. Then, in 1996, 3 grandchildren were born within 2 months of each other. Emily Stubb (Peter and Laurie) was born on February 2, Brandon Vallejo was born

on March 17, and Allison Kramer was born on April 5. The final granddaughter, Abigail Stubb, was born on June 4, 2000.

By not being occupied with a 40-hour work week, I, and Nannette, were able to be a part of their life growing up. Had I continued working, I would have missed most of this memorable time. No regrets.

As a final comment, I have always tried to do the right thing and I would urge others to likewise follow this maxim. You may know or you may never know how your behavior affects the future of others. So do the right thing.