Oral History of Yasoji Suzuki

Interviewed by:
Douglas Fairbairn

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Fairbairn: Okay. We are at the New Otani Hotel in Tokyo, Japan *(Suzuki: Yeah)*, it is June 23, 2016 *(Suzuki: Yeah)*. And I'm Doug Fairbairn and we are here with Suzuki-san (*Suzuki: Yeah)* to talk about your background and your technical career. So thank you for joining us *(Suzuki: Yeah)*. Working from the questions the first thing that we would like to know is have you tell us, what your, when and where you were born and what your early family life was like.

Suzuki: I was born in Kawaguchi City, Saitama-Prefecture on August 1944. My father was founder of a cast metal foundry in Kawaguchi City. My father was a member of municipal government. My father was awarded the medal with blue ribbon in 1955, maybe.

Fairbairn: Do you know what the medal was for? Why did he receive the medal? Don't know?

Suzuki: Don't know. No, no. In addition my family name, Suzuki, is different from my father's family name.

Fairbairn: Is Suzuki, is that your mother's name?

Suzuki: Yes, yes.

Fairbairn: So is there anything in your family life that steered you in the direction of technology? When did you become interested in technology do you remember?

00:02:02:02 – 00:02:23:24
Suzuki: I interested in technology sparked to get assembly of a radio using crystal detector from a stationer's in 1955, maybe.

Fairbairn: You have an interesting little story here. You had a nickname of MacArthur when you were little. Where did you get the name MacArthur when you were a child?

Suzuki: I don't know in detail, but my nickname is MacArthur. Maybe due to my aggressive character so nickname is MacArthur.

Fairbairn: [You were an] aggressive character as a child so people called you [MacArthur], is that from your mother or friends? Don't know?

Fairbairn: So what university did you attend?

Suzuki: I attended Tokai University.

Fairbairn: Tokai? And what was the reason you chose to go there? Why did you choose that university versus some other university?

00:03:48:13 – 00:03:49:03
Suzuki: Yes, Tokai.

00:04:08:11 – 00:04:34:13
Suzuki: Tokai University, started broadcast of FM for the first time in Japan in 1958. So I chose a major of communication engineering.

Fairbairn: FM radio?

Fairbairn: So you had started with a crystal radio. So you were interested in radio and communication?

Suzuki: Yeah.

Fairbairn: When you were going to high school did you find that mathematics and science was easy for you?

Suzuki: A little.

Fairbairn: A little bit?

Suzuki: Yes.

Fairbairn: So you noted here a particular professor who was a strong influence on you, can you tell me about that?

Suzuki: I received a strong influence of “Spirit of Foundation” by Dr. Shigeyoshi Matsumae of Tokai University. [and also a lecture on “Electrical Circuits” by Dr Mitsuo Teramoto.]

Fairbairn: When you were going to the university did you study semiconductor electronics?

Suzuki: No. I study mainly electrical circuit, yeah.

Fairbairn: With vacuum tube circuits or big power electrical circuits.

Suzuki: No no, What should I say…

Fairbairn: Transistors?

Suzuki: Yes, low voltage area.

Fairbairn: Low voltage.

Suzuki: Yeah, yes.

Fairbairn: So when you went to work at Toshiba did you, have you studied anything about transistors or semiconductors before you went to Toshiba?

Suzuki: I studied semiconductor, discrete semiconductor in NHK, Nippon Hohsoh Kyoukai, Japan's national public broadcasting organization, I took the completing graduation thesis in NHK.

Fairbairn: What, I don't understand.

Suzuki: I completed the graduation thesis with semiconductor field in four years in the university.

Translator: So the encounter with the semiconductor is his thesis which he worked at the NHK, in his fourth year at the university.

Suzuki: I encountered with the semiconductor at the first time when I studied and researched for the graduation thesis in laboratory of NHK.

Fairbairn: So you got a bachelors degree in electrical engineering at Tokai University?

Suzuki: Bachelor, yeah. Electrical Engineering Bachelor.

Fairbairn: So you had worked at or you worked at NHK during your senior year, during the fourth year of your studies and that's where you learned about semiconductors is that correct?

Suzuki: I didn't work at NHK. When NHK called "call for paper" for the graduation thesis, I applied for the researches in NHK, and I researched as a volunteer in NHK for one year.

Fairbairn: Fourth year, yeah.

Fairbairn: I understand thank you.

Fairbairn: When you graduated you went to Toshiba. You left the university and went to work for Toshiba?

Suzuki: Yes.

Fairbairn: And how, why did you select Toshiba why?

Suzuki: When I graduated, I was not able to be adopted by the electronics companies. After I graduated, I applied for mid-career employment examination by Toshiba and I was employed as the normal position from Toshiba.

Translator: Japan has a sort of unique systems for employment. Usually when you are fourth year of the college, you apply for the companies and get the employment agreement in the future. However, in his case he didn't go through that way and he graduate from the university. The only way for him to get the employment is to look for a career person's employment and he applied for the position.

Fairbairn: So you describe here what the first thing that you were involved in. So you joined Toshiba Auto Equipment division in April of 1967 *(Suzuki: Yes.)* tell me what you did there originally, first.

Suzuki: My job is realizing battery operated and pocket size calculator of business machine department in Yanagi-cho Works. I went to the central research center of Toshiba during about one month, and I stayed at the laboratory. So after the training period in the laboratory, I moved to semiconductor division in Tamagawa Works. I studied and researched the LSI for battery operated and pocket size calculator in Tamagawa Works.

Fairbairn: Did they want to help develop LSI chip for calculator?

Suzuki: Yes, in Tamagawa Works, I developed CMOS LSI chip.

Fairbairn: So you didn't know anything about CMOS before that. Is it CMOS or is PMOS or is it…?

Suzuki: I can not explain without this document.

Suzuki: At that time, no CMOS device existed in the world. Another engineer of Development Department in Tamagawa-Works began the development of PMOS-IC. On the other hand, I studied and researched CMOS device at the library in Toshiba head office during my free time (usually on Sunday or holiday) for the realizing the battery operated and pocket size calculator. As the result, I confirmed that the CMOS device would become integral part (IC) of pocket size calculator with a battery use. So, I started to develop of CMOS-IC for the future in spite of the opposite comment from top manager for the development of CMOS.

Translator: At the time it was before CMOS, and the majority of the people at electronics department of Toshiba, they studied PMOS and they wanted to develop PMOS for the products. However, this case, one day he was at the laboratory at the headquarter office and he saw technical papers published by RCA. That was his first met with CMOS technologies and some idea came into his mind and he start this is the line for the future. But you know as I said majority people never believed CMOS, they just focused on PMOS. So he just himself forced to work on CMOS.

Suzuki: Finally, I started development of CMOS feeling backdraft against.

Fairbairn: So you got your laboratory to develop a CMOS process, a process to fabricate CMOS chips?

Suzuki: No. The laboratory does not develop CMOS. I know that there are NMOS or PMOS, discrete device separately. So I used the discrete device and completed a CMOS circuitry by combining NMOS and PMOS devices only.

Suzuki: At the time, there are not manufacturing equipment for CMOS process. So we made several equipment by ourselves.

Fairbairn: So you had to do the circuit design and you had to the process development.

Suzuki: Yes, of course.

Fairbairn: But you were convinced that CMOS was the right direction to go.

Suzuki: Yes, I had a strong faith.

Fairbairn: So did you then start to develop a full calculator chip based on CMOS, and how long did that take you to design? One year?

Suzuki: Yes. About one year. I started development of some CMOS-LSIs in 1969 and they completed in 1970. So after that, I started a development of 3-chip CMOS-LSIs at 1970.

Fairbairn: 1969 to 1970.

Suzuki: Yes. After that I received the order of Sharp for calculator LSI. So I started in 1971 to develop of one chip CMOS-LSI for Sharp, and I completed one chip CMOS LSI. In 1972.

Fairbairn: Oh I see, the three chip one was completed in 1971, but Sharp wanted a one chip and so that one was completed 1972. Did Sharp use the three chip in a calculator or did they wait to get the one chip?

Suzuki: Yes.

Suzuki: Three chip LSI was not used because the price was very high, yeah.

Fairbairn: Right it's too expensive.

Fairbairn: So you began the development of a one chip version and that was ready in 1972 and so Sharp did build a calculator from that chip, correct?

Suzuki: Yes.

Fairbairn: And you said that at the same time you started to develop a CMOS standard logic family a 4000 series and a 7400 compatible series.

Suzuki: Yeah.

Fairbairn: And in order to make these CMOS chips work you developed a unique two cycle clock or two phased clock. *(Suzuki: Yes)* And did that improve the performance over a single phase clock system?

Suzuki: Yes, I improved the characteristics. For example, for calculator, the power was decreased by 0.0025%. Weight decreased by 1.5%. So the price also was decreased by 5% comparing with the conventional calculator using discrete devices based on the data in 1973.

Fairbairn: 1973, 40 years later?

Suzuki : I got the result according to the comparison data of calculator at that time.

Suzuki: The power of CMOS-LSI decreased about two digits comparing with power of it on 1973.

Fairbairn: CMOS vs PMOS so.

Suzuki: PMOS, yes. About two digits decrease.

Fairbairn:
For example the PMOS is around 100 and it goes down to one when you use CMOS in 1973.

Fairbairn: The power?

Suzuki: I am sorry. Because the power of PMOS chip is 1 W and it of CMOS chip is 1 mW, it is the factor of 1000.

Suzuki: The LSI is, power of PMOS LSI is one watt and the power of CMOS LSI is one milli watt.

Fairbairn: Okay so it's 1000, factor of 1000.

Suzuki: Yes. 1000 decrease.

Fairbairn: Okay. So you then transferred to a different division Oita Works? It said in May 73 you went to Oita Works to mass produce C^2MOS

Suzuki: No, I did not go to Ohita-Works for work. I explained the technology of CMOS-LSI and I proposed to design (circuit design and layout) COMS-IC in Oita-Works. In short, they mass-produce CMOS chip for calculator in Oita-Works, and establish a design branch for CMOS standard logic chip. At that time, CMOS chip is designed by hand worked because the CAD system is not available, yet.

Translator: At the time Toshiba has manufacturing facilities in Oita in Kyushu. So he visited the plant to explain to the workers there and how to apply CMOS. And also he wanted them to work on a design CMOS standard logic. Standard product design. Probably doesn't happen in the US you have separate responsibilities and you don't expect the workers at the fab to deal with design work, but it happened to Toshiba in Japan.

Fairbairn: Standard product design.

Suzuki: The design of LSI chip took a long time. To solve this problem, I think that the operators in Oita-Works took up to design of CMOS chip. So, I established a design branch (or room) in 1974.

Fairbairn: And actually got the operators to help do the design work.

Suzuki: Yes. I think that it does not happen in US semiconductor companies.

Fairbairn: No. So it says here that you also developed a one kilobit C^2MOS RAM. Did you do that that work or did that was done by someone else in the division?

Suzuki: When I was employed in Toshiba on 1967, I was assigned to Business Machine Department. Then I was transferred to the IC development department on 1971 due to the development of CMOS-LSI for Sharp. At that time, I received a request to develop 1 k-bit CMOS RAM by Business Machine Department. So, I developed 1 k-bit CMOS RAM by myself.

Fairbairn: That was the very first kilobit CMOS RAM. Intel just developed a kilobit NMOS RAM a couple years before that, right? So this was the first kilobit CMOS RAM to be developed?

Suzuki: I don't know if1 k-bit CMOS RAM made by Intel. Our 1 k-bit CMOS RAM dealt with as news in Electronics magazine by USA on 1974.

Suzuki: Here is USA Electronics.

Translator: He's not sure if it is the world's first one kilobit (*Fairbairn : CMOS)*

Fairbairn: The next thing you say here is that you…

Fairbairn: You presented a technology paper “Microcomputer channel TV”. What was I don’t, what is microcomputer channel TV? I don’t understand.

Suzuki: I received a request to develop a customer CMOS-LSI for the consumer electronics TV from Fukaya-Works. We called “a microcomputer channel TV (Electronic Auto-Channel Selection System)”.

Suzuki: We reserve some program for watching TV in advance, and we can watch TV by our request whenever we want to watch TV by using “a microcomputer channel TV”.

Suzuki: So automatic switch on.

Fairbairn: Automatically station, automatic what?

Translator: Automatically TV turn on at the time when you want to watch the TV.

Fairbairn: So did it recor-, so it didn’t record but it would automatically turn the TV on to that channel.

Suzuki: Yes, the TV turns on automatically in accordance with the reserved program and we can watch TV.

Fairbairn: So did that get designed into a television?

Suzuki: Yes, I designed a CMOS chip for a programmable channel TV. And TV Division in Fukaya-Works produced and sold several thousand units TV, maybe.

Fairbairn: I’m sorry say that again.

Translator: The functions to turn on the TV whenever you set up, about a thousand units of Toshiba TVs that function went to the market.

Suzuki: Because the price of TV is very high, yeah.

Fairbairn: So, in 1976, you published a book. Who was that book for, for other engineers to learn about CMOS design?

Suzuki: Of course, it is for engineers. I think that I brought this book here.

Fairbairn: And so these engineers could learn how to design with CMOS?

Fairbairn: And then, you said you also did the world’s first 4K bit CMOS RAM?

Suzuki: Yeah, I developed 4 kilobits CMOS RAM at the first time, in the semiconductor world.

Fairbairn: In 1976? *(Suzuki: Yeah.)*

Fairbairn: And then, you spoke about a new single chip CMOS A/D converter that you developed in 1978, 77-78.

Suzuki: Yes I developed the A/D converter for microprocessor system. In detail, for automobile *(Fairbairn : For Automotive?)*, yes.

Fairbairn: Was automotive a big customer for Toshiba at that time?

Suzuki: Yes, yes.

Fairbairn: Then, in 1978, you say you published a book titled *CRT Display.* What was that about? What did that book cover? What did you talk about there?

Suzuki: This book is video game using TV with cathode ray tube. By using this book, we gave lectures of video game to a game maker in Japan in about 3 months.

Suzuki: Yeah about three months.

Fairbairn: So, you trained them how to design?

Suzuki: CRT display consists of three volumes of books including hardware and software design.

Fairbairn: But I don't, was he teaching them how to design with CMOS for game controller?

Suzuki: We used CMOS standard logic IC, CPU and we developed software for video game. So, we gave lectures of hardware and software for game maker. This book consists of 3 volumes by 3 editions.

Fairbairn: So, you were actually developing a video game system.

Suzuki: Yes, video game system including hardware and software. The contents are fortune telling game and graphic world map display etc., by using dots. 1-edition of the book is hardware, 2-edition is software in monochrome both, and 3-edition is hardware and software in color.

Suzuki: Color games. Include software of course.

Fairbairn: I just don't understand what the book was about. I don't … was it how to design games or how to design the hardware for the… First. First version, oh second version was software.

Suzuki: Yes, first version is for hardware and basic software. The second version is for software. Third version is for color games including the software.

Fairbairn: So you had learned not only CMOS design but also software.

Suzuki: We studied hardware and software with fellow worker for game maker, in order to sell CMOS standard logic IC made in Toshiba. As the results, the market share of CMOS standard logic IC became to top rank in the semiconductor world, but we did not sell software of it.

Suzuki: At the time, there was no the personal computer (PC) existing. So, we want to display graphic picture on a TV screen by using CMOS standard logic IC and CPU etc., as shown in this book. And we wrote and published this CRT book.

Suzuki: I was acting various responsibilities and I am not a typical engineer, maybe.

Fairbairn: You've done many different things and you write books too.

00:52:27:16 – 00:52:29:08
Suzuki:
I wish I brought this CRT book with me.

Fairbairn: So, the next thing you did was to develop an 8-bit microprocessor with CMOS.

Suzuki: CMOS 8-bit microprocessor is a nearly same as Intel type 8080.

Suzuki: CMOS 8080A, yeah. I made this board using the CMOS 8080A.

Fairbairn: 8080 A. Okay.

Suzuki: We developed the 8 bit CMOS-CPU (8080A) aggressively although the top manager did not assign us to make it.

Fairbairn: So, you did you have a team of people working for you at this time?

Suzuki: Engineer was 7 - 8 persons for advanced group and 2 - 3 persons for CMOS 8080A.

Fairbairn: And so you asked them to design 8080A, but it was not assigned by top management

Suzuki: There was no assignment to make 8 bit CMOS-CPU by top manager.

Fairbairn: And did that become a product for Toshiba?

Suzuki: We did not produce CMOS-CPU (8080A) for Toshiba. But we developed and mass- produced CMOS Z80 instead of 8080A by using the technology of it.

Fairbairn: You did not sell the 8080 A. What was the reason for doing it?

Suzuki: We could not receive a license from Intel because there was not a good relation between Toshiba and Intel at that time.

Suzuki: From this relation, Toshiba and Zilog tied up with CMOS Z80 and we dissuaded to sell CMOS 8080A.

Fairbairn: Okay. So, you said the other, the other side we developed and mass produced some CMOS LSI for consumer. Other side meaning other division or what?

Suzuki: The other side means consumer electronics field. In Japan, the industrial electronics is mainly microcomputer, the consumer electronics is mainly TV. In general, the typical company is not covered two field of the industrial and consumer electronics but we are in charge with both field.

Fairbairn: Okay. The next thing you mention here was you published a book titled *Design Digital Speech Synthesizer.* So, you're doing many different kinds of things. You did microcomputers, and games, now digital speech synthesis.

Suzuki: Yes, we developed some CMOS chips for the digital speech synthesis and published a book of the digital speech synthesizer.

Fairbairn: And then you wrote another book titled *A Primer on Microcomputer* which I presume was to help people design microcomputer based systems?

Suzuki: No, this book wrote about basic items for introduction of microcomputer. In other word, this is beginner's course for microcomputer, because the microcomputer was not popular at the time in Japan.

Fairbairn: And was it you said it was adopted by Japan's School Library Association does that mean it was targeted at students or at engineers who…?

Suzuki: No. It was for student.

Fairbairn: So, just to get them familiar with idea of microcomputer based sign.

Suzuki: A book was targeted for students of senior and junior high school.

Fairbairn: So then you speak about PLA and PLD tell me about that program.

Suzuki: We developed PLA using the E^2PROM technology but I did not have software for PLA. So we visited Silicon Valley searching for a partner of PLA. We hope to

receive support of PLA software from PLA maker in USA. But, we could not get the partner in USA. We visited about 10 companies, VTI, MMI and AMD, etc.

Suzuki: We dissuaded from the development of PLA because we did not get a partner for the supporting of PLA software.

Fairbairn: So, then, you worked on a special IC card that is putting a chip on a card is that?

Suzuki: Yes, I designed a card for Visa.. Sample is here.

Fairbairn: TAB you're, doing 3.5 million TAB components per month. TAB is, what is TAB? I forget what TAB stands for… Tape automatic bonding? Tape automatic bonding?

Suzuki: TAB means Tape Automatic Bonding and it was a LSI chip on Tape.

Fairbairn: And that specifically was for use in developing the IC cards or manufacturing them.

Suzuki: IC card did not make up TAB at this time and we supplied CMOS chip for IC card. We supplied TAB for LCD (Liquid Crystal Display).

Fairbairn: The TAB components are?

Translator: Yes, TAB components are for LCD panel *(Fairbairn : LCD).*

Fairbairn: And, then, you got an award from Toshiba's president.

Suzuki: Special prize.

Fairbairn: Because you had made so many important contributions in different areas.

Suzuki: For reason to receive of an award from Toshiba, except field of microcomputer, SRAM, ASIC, the market share of another CMOS devices of Toshiba had become top rank in the semiconductor world at that time. And the market share of microcomputer, SRAM and ASIC of Toshiba was 2 or 4 rank, maybe.

Suzuki: I got a special prize from president (Mr. Aoi) of Toshiba because I carried out the development and mass-production of CMOS-IC in various areas and the market share of Toshiba's CMOS-IC became to top rank in the semiconductor world at that time.

Fairbairn: And, then, in 1990, you transferred to the liquid crystal department.

Suzuki: 1990, I moved to the liquid crystal division. I worked in Himeji Works. I met Tani-san in Himeji, maybe 1992 or 1993.

Fairbairn: What I don't understand.

Fairbairn: So, this was one area where Toshiba was not doing well. You were losing many in the LCD business?

Suzuki: I retired from Toshiba because I received a request to change my job from my teacher (Dr. Teramoto in Tokai University) and I got also a recommendation for the retirement from vice-president (Mr. Egawa) in Toshiba, moreover my job had many losses in LCD business on 1995.

Fairbairn: So, did Toshiba get out of that business did it stop making LCDs?

Suzuki: Toshiba had a joint venture with IBM, it was named DTI. At next time, Toshiba formed a joint venture with Matsusita (Panasonic), it was called TMD. Recently, Toshiba accomplished a change as JDI.

Suzuki: DTI means a company's name of a joint venture between Toshiba and IBM.

Translator: And Toshiba decided not to continue the joint venture. So later on they formed a joint venture with Matsushita which is Panasonic.

Suzuki: The name is TMD Toshiba Matsushita Display, TMD.

Translator: This joint venture did not go well either, and now it is merged to the company called Japan Display.

Suzuki: Background of JDI is Japan government, maybe.

Fairbairn: And what was that one called (*Translator: Japan Display)* JD, Japan Display? (*Translator: JDI) (Suzuki: JD yeah.)*

Fairbairn: And when was that formed, Japan Display?

Suzuki: No, I did not check the established year of JDI. It's a 2011 year, maybe.

Fairbairn: And were all of these efforts DTI and TMD were they all aimed Liquid Crystal Display or other display technologies?

Suzuki: I think that TMD handled LCD and OEL (Organic Electro Luminescence display) but DTI handled only LCD.

Fairbairn: So, you did many many different things. Which one are you most proud of?

Suzuki: I invented the clocked CMOS circuitry.

Fairbairn: Clocked CMOS circuitry. That was used in many different applications. Is that correct?

Suzuki: Yes.

Fairbairn: Was is it widely adopted by other divisions within CMOS or other groups within, I'm sorry, within Toshiba.

Suzuki: Of course, the clocked CMOS circuitry is widely adopted in other division, other groups within Toshiba.

Suzuki: The clocked CMOS circuitry is widely used in other companies also.

Fairbairn: Is there any other, you did so many different things, but is there anything else you would want to tell us about? We covered everything here.

Suzuki: Sorry, I have my motto although it is Japanese English. For the realization of my job target, I had a motto as my motto is FIT. FIT means Fresh Idea and Try, Japanese English. Even if development is "Tried with Fresh Ideas" it will become to the "Infinity Technology in Future". And, I think that feeling, motivation, and guts are very important. They are very important key words on job.

Fairbairn: So, this is what you kept in your mind in managing and encouraging people to focus on fresh ideas and try.

Suzuki: Does typical engineer understand my motto? Because Japanese engineer have a subtle consider, I don't know that is it good motto for my fellow workers?

Fairbairn: Is this for yourself?

Suzuki: It's very difficult.

Suzuki: I performed my job in advance. In other words, I think that the advanced technology is important matter for my job. So, I say to my fellow workers that you must complete your job before you receive indication or assignment from top manager. So, I set up an advance group in my section or department.

Suzuki: For example, I developed 8080A CMOS LSI.

Fairbairn: So you would take some of the people in your group (*Suzuki: Yeah)* and assign them to advanced things that you thought were important.

Suzuki: I put up engineer of 7-8 persons for advance group and 2-3 persons for CMOS 8080A.

Fairbairn: How many people did you assign to the 8080A design?

Suzuki: Maybe two or three persons for CMOS 8080A.

Fairbairn: Very small group.

Suzuki: Yeah, I covered engineer of 2- 3 persons to develop 8080A though I am not assign many engineers.

Translator: Very limited human resource.

Fairbairn: And they did the circuit design as well as the mask layout?

Suzuki: Yes, very heavy work, what I should say.

Fairbairn: Big job.

Fairbairn: Okay. Well, thank you very much for spending your time and explaining your, all of the many accomplishments and awards. So, congratulations and thank you very much.

Suzuki: I'm sorry for poor English. I express my heartfelt thanks to Dr. Douglas Fairbairn san and Ms. Naoko Tani san.

END OF INTERVIEW

