The learnings and findings

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Introduction

This essay aims to talk about what I have learned these two weeks about the IC, nanotube, etc. First, I have to claim that I am just a sophomore student which means I have not studied too much about the IC and I still could not understand some of the information posted on the background reading. Meanwhile, these two weeks meet our final exam weeks. I have to spend most of my time preparing for the final test, so that it is probably I could not read the reading with very careful. What I could do is to try my best to finish reading the passages and deal with the assignment. If there are some place where I do not handle well, hope professor could understand.

Main part

The first passage was written by Gordon E. Moore in 1965, which title is ‘Cramming More Components onto Integrated Circuits’. In this essay, Mr. Moore predicts the future of the development of the Integrated circuits and compares it with the present situations at that time. First, he claims confidently that the integrated circuits will appear in many areas and fundamentally change the world from automobile to wrist watch, from telephone communications to computers, which most of them are proved right. Then Mr. Moore uses 9 specific points to support his idea.

Every parts of the essay are significant and meaningful, while this passage is not a traditional academic essay. Mr. Moore chats through reliability, cost, yields, heat problems, etc. to outlook ten years later. However, one point made the passage become famous, that is what we call it later: Moore’s Law. Mr. Moore states that “The complexity for minimum component costs has increased at a rate of roughly a factor of two per year”. Of course, ‘per year’ was modified to ‘per eighteen months to two years’, however what amazed us is that the future development strictly followed the predict curve. That’s a fantastic fact. And for nearly 55 years it is possible that it still works. We know for sure that it indeed faces some difficulties, but we hope that we will finally find a way to solve that no matter what kind of field.

The second passage is also famous. It was written by Robert H. Dennard. The paper mainly considers the characterization of a very small MOSFET which is suitable for the digital integrated circuits. Nevertheless, this is not why it become famous. The most important thing in this paper is what we called ”Dennard scaling” nowadays, which indicated that if the size of the MOSFET keep going small, because of the decrease the voltage and current, the power would decreased with the same proportion with the size. That is to say, in the same size, no matter how much MOSFETs we put, it costs the same power. So we do not have to consider the heat problems. This is the most significant of the paper. According to the Internet, I found that this rule became famous and important before early 21st when engineers found it could no longer be sustained with the feature sizes below 65nm because of the exponential growth of the leakage current. Which means we have to consider the cooling problems.

According to the two paper above and the information from the internet, we have to face the truth, we need a revolution in the electronics field. How to change? Nobody knows which way is right. However one possible way is carbon nanotube.

The third paper aims to solve the question above by using the carbon nanotube. From this passage, I understand CNT (carbon nanotube) could be a potential material which is outperform than silicon. CNT has many perfect characters including electrical, physical, thermal properties, etc. which are essential for building revolutionary circuits. Even though there are lots of problems from the intrinsic to extrinsic, they are solvable not external. In the passage professor and his team overcome lots of difficulties and truly employ the CNT to build certain parts of the circuit. It could be used as a computer and of course it can operation some of the functions. Although it not looks as a real computer as we always use today, it does a revolution for a computer just made by carbon. In the last of the paper, the paper shows the fabrication process of the CNT. It looks gorgeous. While it is too hard for me to understand them all. Most of the relevant knowledge I have not heard before, so it could say that it is my first acquaintance with these knowledge. It absolutely an acquisition.

The forth paper also relate to the carbon nanotube. The whole passage intend to clarify that the CNFET (carbon nanotube field-effect transistor) could handle the imminent problem that the silicon chip have tough time to scale, at meantime, it has some benefits like improving the energy-delay. However, the CNFET still have it’s own problem. Some process variations would lead to reduce circuits yield, increase the susceptibility to noise and variations in CNFET, which are disaster to the CNFET. At last the professor and his team find an effective method to evaluate the effects and employ a certain methodology to detect and handle the problems. Finally, It proved that the method is feasible and it could overcome lots of challenges in many situations as well.

Well, the fifth paper analysis the binary metal-oxide using as random access memory , which is RRAM. In the paper, the professor reviews its proposed resistance switching mechanisms, materials properties and device characteristics and many other details of the RRAM. Lastly, the author concludes the paper with a future outlook for RRAM and its applications for reconfigurable logic and neuromorphic computing. From this passage, I firstly know the RRAM which is a newborn technology and it is totally different with the normal RAM. RRAM use the different current to change it value of resistance in order to memory. This is a high-density, fast, compatible with integration with conventional components. It absolutely have bright future. And because it power-efficiency it could be used as artificial synapse element for hardware neuromorphic computing. That’s fantastic, isn’t it.

The last paper is talking about, N3XT, a chip based on the Nano technology. For the reason that demand for new technology to handle the rising data. The conventional IT services begin to exposure its weakness and begin powerless. At this time, the N3XT is not a thing that want to be, but have to be. It is so profound that could affect some great national projects and challenges. And this chip, by using the nanotube and many other high-techs, could significant solve the big data problem fast and effectively.

In conclusion, from these two weeks, I learned a lot, gained a lot, realized a lot. I probably know that Nano-technology is one possible way to change the world. Also, I studied many useful knowledge such as the MOSFETs, the basic of digital circuits, CNFETs, etc. It possible that these knowledge could lay foundation for my future career in a way.

I also realized that with the stop of some of the Laws, we have the responsibility to explore a possible solution of the future integrate circuits. We need to shape our own future through our own hands!