上海交通大学 毕业设计（学士学位论文）
单独工作报告

SHANGHAI JIAO TONG UNIVERSITY

CAPSTONE DESIGN (BACHELOR'S THESIS)

INDIVIDUAL CONTRIBUTION REPORT

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My name is Jiajin Wu. I am a senior student major in mechanical engineering at the University of Michigan-Shanghai Jiao Tong University Joint Institute. By convention, the capstone design is assigned by groups. The thesis of our capstone design is "Non-contact thickness measuring device for coating process in battery manufacture." My group members are Zefang Li (major in Mechanical Engineering), Yuenong Ling (dual degree in Mechanical Engineering and Engineering Physics), and Zhiyang Chen (major in Computer Science). Our thesis is a multi-disciplinary program relevant to mechanical engineering, electrical engineering, and computer science, while our group members also have various academic backgrounds.

Since we only have four members, and our thesis is a comprehensive campaign consisting of hardware and software, the division of work is very complicated. Generally, we divide our work based on two principles: capability and equality. Zefang Li is the leader, responsible for the team affairs, the assembly, and prototype testing. Yuenong Ling is responsible for the simulation of working conditions and assisting Zefang Li and me. Zhiyang Chen is in charge of the software part of the measuring system, including the transmission of data and user interface design. Since I am pretty good at using computer-aid design software (like SolidWorks) to build 3D models, my primary duty is to design the measuring system's mechanical (hardware) parts.

Designing the mechanical parts of the whole measuring system is not an easy job. There are several steps you must undergo before the release of the final product. The first step is to be familiar with the engineering specifications and brainstorm the concept of design. For this project, the essential specifications are stability and maneuverability. Since we have chosen the confocal displacement sensor, our device should be as stable as possible to guarantee the repeatability of the high-precision thickness measurements. Meanwhile, since we must detect multiple points along the parallel and perpendicular direction of the product line, while the sensor we have chosen can only detect the thickness of a certain point, our device should have a specific mechanism for maneuverability. Based on the last two requirements, we have brainstormed several design concepts and evaluated their advantages, disadvantages, manufacturability, reliability, and cost before making the final decision.

The second step is to build the authentic 3D model with computer-aid design software. The more accurate you have built your model, the easier you can find the small but fatal design mistakes in advance. The modeling process requires you to elaborate on the dimensions of all components and define the appropriate mates to assemble them while getting rid of the interference and misfunction of parts. I also have to determine the models of the standard parts that we would like to use, check their dimensions, and contact the vendors to purchase them. If it cannot be found in the market, I would contact the manufacturer to customize the parts we need. Also, we have manufactured some of the parts by ourselves. In this step, our leader Zefang Li has helped me purchase necessary parts and contact vendors for detailed information.

The last step is to inspect and refine your design continuously. I have always published the current progress to the shared folder to verify and brainstorm with my teammates. In this process, Zefang Li and Yuenong Ling have helped me a lot, as they have proposed many novel ideas and solutions to the existing problems. Also, Yuenong Ling has simulated the performance of my design under actual working conditions with the finite element methods provided by ANSYS. After a dozen iterations, we have determined the final design of our prototype.

Since I should be the most familiar with our design, I have also shouldered the responsibility to assemble the components of our device. In detail, to assemble the parts as what we have designed and construct the hardware part of the measuring system—acknowledgment to Zefang Li and Yuenong Ling for their assistance in this time-consuming process. I have also participated in the testing process to make the whole system, including the sensors, motors, and moving mechanism, work properly.

I have to admit that even if we have already inspected the 3D model design many times, there are still many unexpected things during the assembly process. For example, the quality control of customized parts is so terrible that some of the actual product's dimensions turn out to be far from our expectation, resulting in the vulnerability, unreliability, or even misfunction of our measuring system. This experience taughts me a lesson that when you ask someone else to manufacture something for you, you would better list all your requirements no matter how simple and obvious they are from your

perspective. Otherwise, what others are thinking about is likely absolutely different from yours and leads to failure consequently.

Another lesson I have learned is always trying to think a step further about the procedures after your design. To be more specific, taking into consideration the manufacture (manufacturing process, deviation in dimension), assembly (tools and materials used, techniques to assemble and dismount), and testing (convenience, performance) before it is too late. Sometimes, if you have missed parts of these considerations, you would likely fall into some trouble in the following steps paying for your carelessness. I forgot to design the calibration stage for our sensors, and it may cause uncertainties or even errors during the calibration and measuring processes. Though I have reflected on myself and make a temporary complement, the overall effect of calibration is still unsatisfactory.

We have equally distributed the workload to each member for technical communication parts, including the presentations, reports, slides, posters, brochures, videos, and final thesis. Despite the discrete parts we have cut the technical communication assignments into, everyone is familiar with his part and other parts, which I think is quite good if everyone knows everything.

In a nutshell, although we only have four people, my teammates and I have all contributed a lot to this graduation thesis, and we hope that our efforts would pay off in the end.