

CHAPTER 5

CONCLUSION AND FUTURE WORKS

5.1 Conclusion

The main task of this project is to design the two stages CMOS operational amplifier using Mentor Graphics software. Advanced CMOS analog integrated circuit design approach is used to design the CMOS operational amplifier. The design consists of two parts i.e. the circuit design and the layout design. Simulation on the operational amplifier circuit and its layout is done to investigate the results of design circuit and its layout. Based on the results and the analysis, it can be concluded:

The design process that was followed resulted in a complete CMOS operational amplifier that at least met and, in a few cases, exceeded the design objectives by a large margin. The notable performance areas were the output swing of $\pm 1.81\text{V}$, and the common mode input range of $+ 1.08\text{V}$ and -1.81V . The deviation with the calculated values is because of short channel effects. The CMOS operational amplifier is working properly within the operating voltage 2.5V .

The layout for the CMOS operational amplifier is successfully drawn. The DRC and LVS simulation were done on the layout. The result shows a successful layout with zero errors is completed. A great deal was learned in the layout design process, including how to approach the errors, the tradeoffs involved in a CMOS op-amp design, patience, and how to stay up late.

As a conclusion, the project with the title of Design and Simulation of CMOS Operational Amplifier had been done successfully. I felt that lot of knowledge was gained from doing the report. Some redesign was necessary in order to meet the exact specification values of the CMOS operational amplifier. Overall, it was a worthwhile and valuable experience.

5.2 Recommendation for future project

Based on the results analysis and the conclusion of it, there should be future improvements on the CMOS operational amplifier. Below are the suggestions and guide for future improvements:

First of all, the two stage CMOS operational amplifier was seen give satisfactory performance for most typical applications, however cascode configuration need to be tested in the near future to improve the performance of the two stage operational amplifier in the areas of gain and stability.

Next, in this project, the techniques for testing various parameters of the operational amplifier is very complex as the design of the operational amplifier itself, thus methods more suitable for testing the parameters of the operational amplifier is necessary.

The final recommendation for this project is the layout of the CMOS operational amplifier need to be proceeded for fabrication for verification by the industry. This will make sure a complete CMOS operational amplifier is designed and ready for fabrication.

5.3 Commercialization Potential

The CMOS operational amplifier designed in this project contains very basic architecture. In order to be commercialized some redesign is necessary.