Microwave Filter Projects for Wireless Communications

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This presentation is a digest of Microwave Filters class projects performed by the graduate students at Syracuse University. Over twenty-five enrolled students formed several groups and they were assigned to design, simulate, build, and test various types of microwave filters for wireless communication systems. Some of the design requirements were low loss, compact size, broad-band, and low harmonic level. The course was taught by the authors and the projects were supported by some local companies. Thus, the course covered both theoretical and practical aspects of the microwave filter design which lead the students to have a good insight into the topic.

During the course, detailed network syntheses of microwave filters were studied and lumped element prototypes were obtained. After transforming the prototype circuits to the distributed elements, circuit simulators such as AWR, Genesys, and Ansoft Designer and electromagnetic simulation (EM) tools such as Sonnet, Ansoft HFSS, and CST were used. At every stage of the task, the software tools were intelligently chosen during the simulation and optimization. Thus, the power of every software package was contributed to the projects. Wisely co-simulating by using EM tools and circuit simulators gave the best design and eliminated the amount of cut-and-try in the lab.

The optimum simulated circuits were built and tested. Then, the simulated and measured results are compared and analyzed. After having a good understanding of the simulation tools’ accuracy, the measurement results were discussed between the groups. The students finally presented their complete projects to a group of engineers’ from various local wireless/microwave companies and the professors from the department. A comprehensive discussion on the results and the usage of the filters in wireless communications systems was held in the presentation.

After digesting the class projects, this summary is prepared as a quick reference for the filter design, simulation, and the usage of the microwave filters in wireless communications systems.