6.1 SUMMARY

Signal Integrity holds several advantages over other designing strategies, which ensure the quality of the signal at an early stage. This thesis presents new approaches in solving Maxwell’s field equations for estimation and reduction of crosstalk in the PCB’s trace line. Various field-solving approaches are studied, and the essence of achieving signal integrity is understood to a greater extent. For checking the efficiency of this framed technique, various trace schemes are examined. The outcomes are then calculated and endorsed by using the comparison of simulated data with the measured data of the proposed system.

This thesis is divided into two phases. Phase I deals in designing different shield structured used with multi-conductor transmission lines. Initially, a double trace conductor is designed as a reference structure. Double trace with continuous shield, double trace with discrete shield, double trace with slotted conductor and double trace with dumbbell conductors are novel structures designed to achieve isolation between traces. Phase II deals with designing step and slant traces instead of conventional rectangular traces. With minimum separation between the traces and by introducing step and slant structures good signal quality at higher-speed signal transmission is achieved.

The performance inferences of phase I work is briefed as follows: Simulated data of double trace with discrete shield exhibits better performance in terms of return loss, insertion loss, near end crosstalk and far end crosstalk as
– 17.75 dB, -7.194 dB, -18.182 dB and -4.006 dB respectively. Measured data of the same structure gives return loss, insertion loss, near end crosstalk and far end crosstalk as -39.54 dB, -28.10 dB, -38.66 dB and -46.61 dB. From the observations it is found that the structure shows stable performance at higher frequency range of 3-5GHz. Irrespective of reduced number of discontinuities, discrete shield exhibits better performance as the discontinuities are placed in the shielded trace near the source and termination port. In addition to the estimation of crosstalk numerically, graphical representation of crosstalk is achieved by estimating eye pattern for the proposed structures. From eye pattern analysis it is evident that the interference of signal is reduced due to the shield traces. Different shield traces are examined and concluded that the double trace with discrete shield trace is superior to the other proposed structures.

Phase II work is proceeded by designing step and slant shaped traces and their performances are estimated by simulating and measuring return loss, insertion loss, far and near end crosstalk. Among the proposed structures, slant conductors show better performance than the step conductor in terms of the above parameters. Simulated data of slant shape trace conductor exhibits return loss, insertion loss, far end crosstalk and near end crosstalk as – 40.63 dB, -5.85 dB, -32.2 dB and -42.4 dB respectively. Measured results of slant shape trace conductors found that return loss, insertion loss, far and near end crosstalk are -44.95 dB, -19.82 dB, -35.3 dB and -44.2 dB respectively. Inter symbol Interference of the proposed structure is studied by estimating eye pattern of the same. Satisfied performances are evolved from slant shape trace conductor.

ADS 2011.05 have user friendly environment for EM modeling of traces in terms of Signal Integrity and Power Integrity for better utility of the field solvers.
6.2 FUTURE RESEARCH DIRECTIONS

In future, different form of trace structures shall be developed and used in high speed PCBs for various purposes. This thesis is just a brick, contributed to Signal Integrity community. A different approach for new research initiative in the related areas has to be carried out. This thesis focus on improving the signal quality at multi conductor transmission line environment in terms of reducing crosstalk, reducing propagation delay by selecting proper material for fabricating and analyzing the effect of discontinuities in the trace conductors with or without shields.

In addition, real-world problems shall be addressed and Signal Integrity standards made compulsory for a product to meet the commercial market. Still, Signal Integrity is a nightmare to the designers rather than the customers. Signal Integrity should be made user-friendly and reach the knowledge of ordinary persons.

Furthermore, scholars have recognized and initiated their analysis focusing on the open Signal Integrity solvers. More advanced methods, which will handle user-friendly SI analysis in a wider range of issues are definitely becoming an emerging field of research.