# ABSTRACT

Impedance matching techniques for ethernet communication systems

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In modern local area networks, the communication signals sent from one computer to another across the lines of transmission are degraded because of reflection at the receiver. This reflection can be characterized through the impedances of the transmitter and the receiver, and is defined by the Institute of Electrical and Electronic Engineers (IEEE) as the S11 return loss. The specifications for S11 return loss in Gigabit Ethernet are given in terms of magnitude only in the IEEE 802.3 guidelines. This does not fully take into account, however, the effects of frequency dependent impedances within the bandwidth of interest. With a range of 30% error in the category 5, or CAT5, transmission line impedance used in this specification and no further requirements for individual components within the Gigabit Ethernet port, such as the RJ45 magjack or the physical layer, the system can easily be out of tolerance for return loss error. A simple impedance matching circuit could match the CAT5 cable to the physical layer such that the return loss is minimized and the S21 transmission is maximized. The first part of the project was commissioned by Dell Computer to characterize the return loss of all of its platforms. This thesis goes further in the creation of a system that can balance these two impedances so that the IEEE specification failure rate is reduced with the lowest implementation cost, size, power and complexity. The return loss data were used in the second phase of the project as the basis for component ranges needed to balance the impedance seen at the front of the physical layer to the CAT5 transmission line. Using the ladder network theory, an impedance matching circuit was created that significantly reduced the S11 return loss in the passband of the equivalent ladder network. To manage this iterative process, a control loop was also designed. While this system does not produce the accuracy that a programmable finite impulse response (FIR) filter could, it does improve performance with relatively minimal cost, power, area and complexity.