Effect of Nanosecond Electrical Discontinuities in High-Speed Digital Applications

Nanosecond discontinuities are a concern in separable-interface connectors. Speculation about their causes includes the structural movement between perfectly clean and flat contact surfaces and/or surface irregularities and presence of surface films. Both of these scenarios are considered here in the context of high-speed transmission (i.e. greater than 1 Gbit/s) in backplane connectors. Because such connectors have gold-to-gold mating surfaces, oxide-related discontinuities such as may occur with tin, silver, or aluminum interfaces are not considered. This paper considers the propagation speed of a stress wave to show the unlikelihood of nanosecond discontinuities arising due only to macroscopic structural shock and vibration. Thus, contact physics and the presence of contact imperfections, are required to cause nanosecond-level intermittences.

Assuming that a discontinuity of one or several nanoseconds does occur, the short duration of the event permits only a minute separation between the two contact surfaces. This effect is equivalent to and modeled as the insertion of a very large series capacitor between the two conductors. At high frequencies, such a capacitor would behave quite similarly to a short circuit. Circuit simulations of a communication link and the resultant insertion loss and eye patterns show that these discontinuities do not disrupt high-speed data transmission.