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Magnetic Current Imaging of defects in Integrated Circuits using a MR scanning system

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The new packaging solutions introduced by semiconductor device manufacturers require powerful, accurate and true 3D failure localization techniques to yield Non-Destructive Failure Analysis (FA) useful in this new era of increasingly complex microelectronic devices. Magnetic Current Imaging (MCI) is one such technique that relies on the reconstruction of the current path inside a faulty Device-Under-Test (DUT) from the magnetic fields created in its surroundings, to non-destructively inspect it for the presence of physical defects or electrical malfunctions, such as short circuits.

State-of-the-art Magnetic Tunnel Junctions developed at INESC-MN are a very interesting option to perform magnetic field sensing in MCI, compared to the current commercial options that rely on a combination of a SQUID and single GMR sensors mounted on the tip of a scanning probe. This is mostly due to their high sensitivity to the magnetic field and their very small size, which enables scanning at very high spatial resolution when near the surface of the DUT.

In a partnership with Neocera, LLC, I propose to work on a new design of a MCI system, which is based uniquely on MTJ sensors mounted on a scanning probe tip. The goal is to enhance the accessible spatial resolution obtained with magnetic scans in Failure Analysis without compromising the SNR, to better perform fault isolation in devices where the average defect size is increasingly smaller.

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