Title: Fast Switching in MTJs with a Composite Free Layer

Dr. Viktor Sverdlov*, Alexander Makarov, and Siegfried Selberherr
Institute for Microelectronics
Austria

Abstract

An important task of micro- and nanoelectronics is to establish a new universal memory type in a near future. Unlike DRAM and flash memories, a new universal memory should not require electric charge storing and may benefit from alternative principles of information storage. For successful application a new universal memory has to be non-volatile and must also exhibit low operating voltage, low power consumption, high operation speed, long retention time, high endurance, and a simple structure. The spin transfer torque (STT) RAM is one of the most promising candidates for future universal memory. We present a brief overview of the current state-of-the-art of this technology and outline future trends and challenges from the perspective of modeling and simulation. In particular, we investigate the properties of a magnetic tunnel junction (MTJ) with a composite soft layer by exhaustive micromagnetic simulations. The structure CoFeB/MgO/CoFeB/MgO/CoFeB with an elliptical cross-section of different size is considered. The system with a composite free layer is obtained by removing a central stripe from the monolithic free layer. The MTJ with a composite free layer switches two to three times faster than the one with a monolithic layer. We have found that the switching energy barrier in the MTJ structure with the composite layer is decreased and becomes equal to the shape anisotropy energy barrier responsible for thermal stability. This results in a switching current density reduction.

Biography

Viktor Sverdlov received his Master of Science and Ph.D. degrees in physics from the State University of St.Petersburg, Russia, in 1985 and 1989, respectively. From 1989 to 1999 he worked as a staff research scientist at the V.A.Fock Institute of Physics, St.Petersburg State University. During this time, he visited ICTP (Italy, 1993), the University of Geneva (Switzerland, 1993-1994), the University of Oulu (Finland, 1995), the Helsinki University of Technology (Finland, 1996, 1998), the Free University of Berlin (Germany, 1997), and NORDITA (Denmark, 1998). In 1999, he became a staff research scientist at the State University of New York at Stony Brook. He joined the Institute for Microelectronics, *Technische Universität Wien*, in 2004. In May 2011 he received the *venia docendi* in microelectronics. His scientific interests include device simulations, computational physics, solid-state physics, and nanoelectronics.