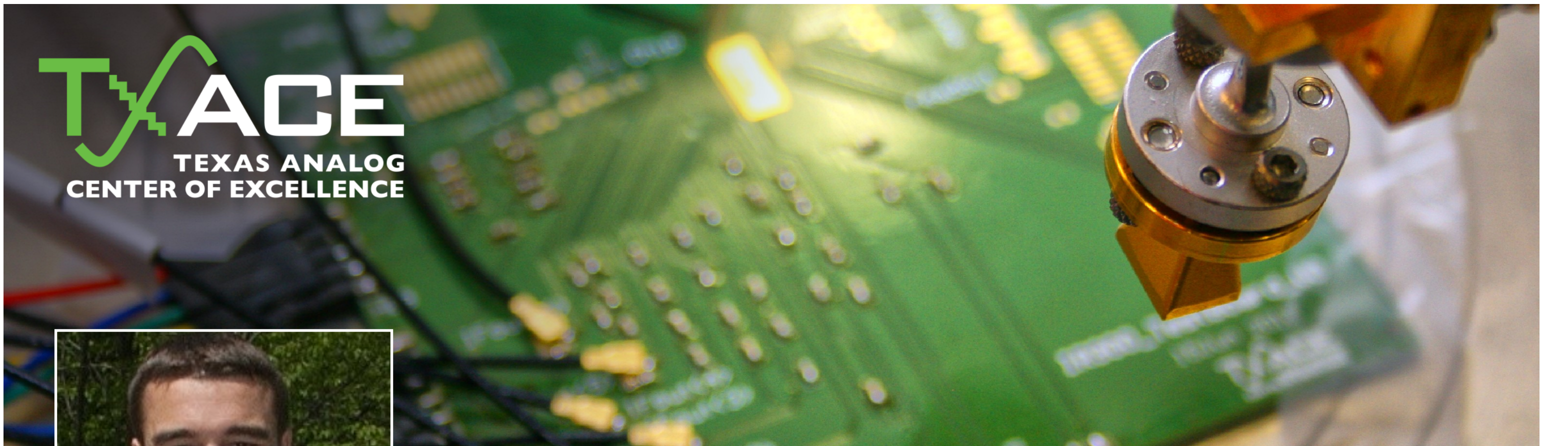

TxACE
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Spintronic Phenomena for Reversible, Neuromorphic, Reservoir, and Secure Computing

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BIO

Dr. Joseph S. Friedman is an assistant professor of Electrical & Computer Engineering at The University of Texas at Dallas and director of the NeuroSpinCompute Laboratory. He holds a Ph.D. and M.S. in Electrical & Computer Engineering from Northwestern University and undergraduate degrees from Dartmouth College. He was previously a CNRS Research Associate with Université Paris-Saclay, a Summer Faculty Fellow at the U.S. Air Force Research Laboratory, a Visiting Professor at Politecnico di Torino, a Guest Scientist at RWTH Aachen University, and worked on logic design automation at Intel Corporation.

Dr. Friedman has been a member of the editorial boards of *IEEE Transactions on Nanotechnology* and *Microelectronics Journal*, has been on the technical program committees of DAC, DATE, SPIE Spintronics, NANOARCH, GLSVLSI, VLSI-SoC, ICRC, NICE, ICECS, NMDC, and LASCAS, and the ISCAS and AICAS review committees. He has been a member of the organizing committees of NANOARCH, VLSI-SoC, and DCAS, is the Vice Chair of the Dallas Chapter of the IEEE Electron Devices Society, and is the founder and chairperson of the Texas Symposium on Computing with Emerging Technologies (ComET). He has also been awarded the NSF CAREER award.

ABSTRACT

The rich physics present in a wide range of spintronic materials and devices provide opportunities for a variety of computing applications. This presentation will describe four distinct proposals to leverage spintronic phenomena for reversible computing, neuromorphic computing, reservoir computing, and hardware security. The presentation will begin with a solution for reversible computing in which magnetic skyrmions propagate and interact in a scalable system with the potential for energy dissipation below the Landauer limit. An approach for neuromorphic computing based on the stochastic switching of spin-transfer torque magnetic tunnel junctions (MTJs) will then be discussed, including results from the first experimental demonstration of a neuromorphic network with MTJ synapses. Next, a reservoir computing system will be described that efficiently leverages the dynamics of frustrated nanomagnets. This presentation will conclude with a logic locking paradigm based on nanomagnet logic, the first logic locking system that is secure against both physical and algorithmic attacks.

Friday, May 20, 2022 at 1:00 – 2:00 p.m.
Osborne Conference Room (ECSS 3.503)

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