SEMINAR ANNOUNCEMENT

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
COLLEGE OF DESIGN AND ENGINEERING
Website: https://cde.nus.edu.sg/ece

Area: Microelectronic Technologies & Devices

Host: Professor Wu Yihong

TOPIC	:	**Vector Magnetometer Based on a Single Spin-Orbit-Torque Anomalous-Hall Device**
SPEAKER	:	**Mr. Chen Xin** **Graduate Student, ECE Dept, NUS**
DATE	:	**Wednesday, 21 December 2022**
TIME	:	**2.00PM to 2.45PM**
VENUE	:	**Join Zoom Meeting:** **https://nus-sg.zoom.us/j/89703044835?pwd=c1dpdFVnTHhmbmRnSUtWUmtqTGtzUT09** **Meeting ID: 897 0304 4835** **Passcode: 594999**

ABSTRACT

In many applications, the ability to measure the vector information of a magnetic field with high spatial resolution and low cost is essential, but remains a challenge for existing magnetometers composed of multiple sensors. Here, we report a single-device based vector magnetometer, which is enabled by spin-orbit torque, capable of measuring a vector magnetic field using the harmonic Hall resistances of a ferromagnet (FM)/heavy metal (HM) bilayer with superparamagnetic behavior. Under an ac driving current, the first and second-harmonic Hall resistances of the FM/HM bilayer show a linear relationship with the vertical and longitudinal component (along the current direction) of the magnetic field, respectively. By employing an L-shaped Hall device with two orthogonal arms, we can measure all the three field components simultaneously, thereby detecting both the amplitude and direction of magnetic field in a three-dimensional space. As proofs of concepts, we demonstrate both angular position sensing on the three coordinate planes and vector mapping of magnetic field generated by a permanent magnet, both of which are in good agreement with the simulation results. Crosstalk between vertical and longitudinal field components at large field is discussed using theoretical models.

BIOGRAPHY

Chen Xin is currently a Ph.D. student under the supervision of Professor Wu Yihong in Electrical and Computer Engineering Department, National University of Singapore. His research mainly focuses on the characterization of magnetic multilayers and magnetic sensors.