Docket #: S22-093

Wide frequency 2DEG Hall-Effect Magnetic Sensor

Stanford University and University of Arkansas researchers in the XLab have developed a cost effective, 2dimensional electron gas (2DEG) Hall-effect magnetic field sensor that can operate from direct current to nearly Gigahertz frequencies. As power electronics shrink, they operate at higher frequencies. Modern techniques to extend Hall effect sensor operations beyond current spinning (100KHz) are complex and require a variety of electronics to eliminate induced noise. The XLab solution uses the Hall effect sensor with current spinning at low frequencies, then the Hall effect sensor with an inductive pickup at high frequencies. The threshold frequency is based on geometry, sensitivity and current. A simple microcontroller tracks output, backs out the frequency of the magnetic field and magnetic field strength, and transitions from current spinning to passive mode with low energy consumption. (See Figure 1.) The lower cost and lower complexity XLab solution is ideal for turbines, motors, converters, inverters, and engine systems that operate at DC / low frequency to high frequency in the 10s of MHz and beyond.

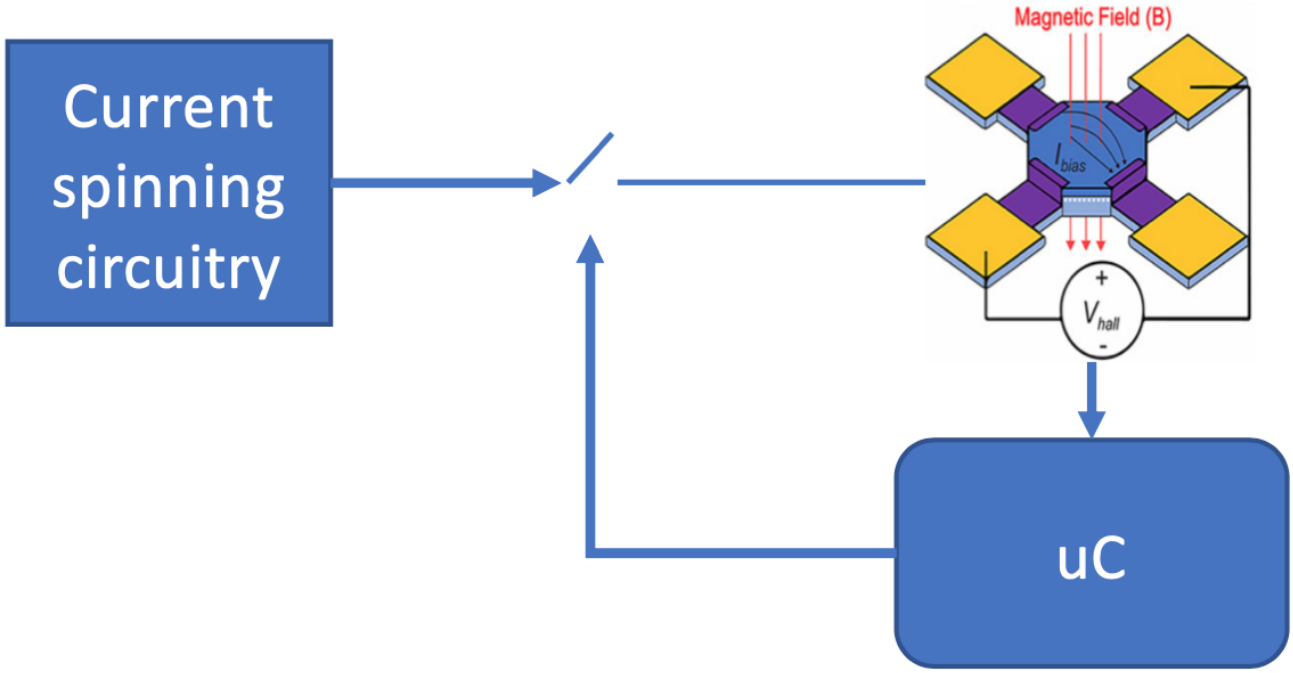

Figure 1 Wide frequency 2DEG Hall Effect Magnetic Sensor Solution
Figure courtesy XLab

Stage of Development – Proof of Concept
The XLab has a benchtop proof of concept prototype that is being tested in a real-world motor with University of Arkansas, University of Illinois Urbana-Champaign (UIUC), NASA and PC Krause and Associates (PCKA), as a Center for Power Optimization OF Electro-Thermal Systems (POETS) Industry Advisory Board (IAB) project.

Applications

- Measuring magnetic fields
- Detection and control of displacement, speed, angle, and rotation speed
- Turbines, motors, DC-DC converters, inverters, engines, etc.
- Diagnosing health of motor systems used in automotive, aerospace, etc.

Advantages

- **Ultra-wide frequency range** (DC to GHz)
- **Lower cost**
- **Lower complexity with fewer circuits and no need for temperature compensation**- dual systems with a coil + hall effect sensor suffer from temperature mismatch requiring electronics for temperature compensation and each system requiring individual circuitry.
- Passive mode **lowers energy consumption**

Innovators

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