

Advanced signal processing and magnetic layer stacking promises to increase hard drive capacity and reliability

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The next generation of magnetic hard drives could be based on a new combination of technologies developed by A*STAR researchers aimed at increasing performance by stacking hard disk data and tracking bits in separate layers.

A conventional magnetic hard drive contains one or more thin magnetic platters that spin at very high speeds. Data is recorded on the platter in narrow circular tracks, and is read and written by a head that floats just nanometers above the magnetic surface. The head is kept on track by special magnetic 'servo' tracks that are arranged radially around the disk like the spokes on a bicycle wheel.

"As the head crosses the servo spokes, which for a typical disk happens up to 400 times per revolution, the servo information is used by the drive to push the head back to the center of the data track," says Kheong Sann Chan from the A*STAR Data Storage Institute.

The problem with existing servo systems is that due to the need to minimize the number of servo spokes on a disk, which take up disk space that could otherwise be used to store data, the head is only repositioned for a very small fraction of time. In-between servo spokes, the head is susceptible to disturbances like shock and vibration.

Chan, Yibin Ng and their colleagues have come up with a method to add

a second [magnetic layer](#) on the disk entirely dedicated to holding servo information and keeping the head continuously on track while the disk spins at over 120 kilometers per hour beneath it.

"We developed a dedicated servo scheme consisting of two stacked magnetic layers: the top one for data and an underlayer to hold servo information," says Chan. "This means that servo information can be available all the time rather than just when the head is over the servo spokes. The scheme also frees up space on the data layer to hold more information."

Chan's team married the dedicated servo layer with a signal processing technique designed to separate the two sets of magnetic information read by the head. Signal processing has been a significant obstacle for this technology, but the researchers overcame it by matching the servo detector on the head to the specific pattern of servo data.

"This dedicated servo technology delivers an increase in overall system performance but will require some changes to how the servo patterns are written, which the hard drive industry is currently evaluating," says Chan.

More information: Yibin Ng et al. Signal Processing for Dedicated Servo Recording System, *IEEE Transactions on Magnetics* (2015). [DOI: 10.1109/TMAG.2015.2456851](https://doi.org/10.1109/TMAG.2015.2456851)

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