MMM 2022 Conference

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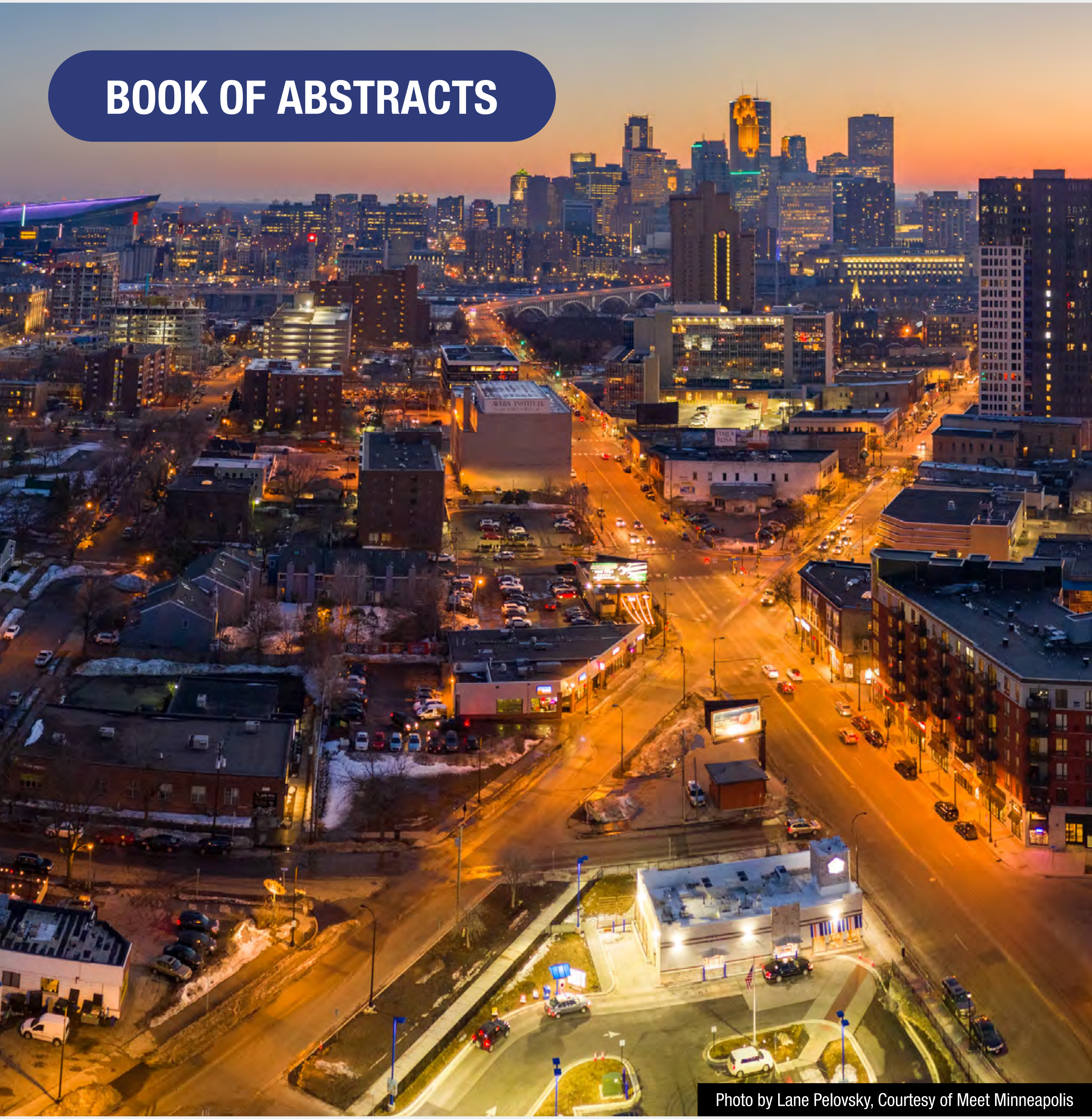
BOOK OF ABSTRACTS



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1-8. [3] Victora, R. H., and Pin-Wei Huang, IEEE Transactions on Magnetics 49.2 (2013): 751-757. [4] Natekar, Niranjan A., and R. H. Victora, IEEE Transactions on Magnetics 57.3 (2020): 1-11.

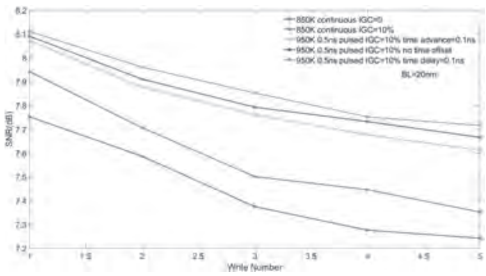

Fig1. SNR variation of pulsed laser and continuous laser for different IGC for ECC media. Write Number is the number of times the adjacent track is overwritten. ECC media is made up of 3nm superparamagnetic writing layer and 6nm FePt storage layer. Bit length is 20 nm and velocity is 20 m/sec.

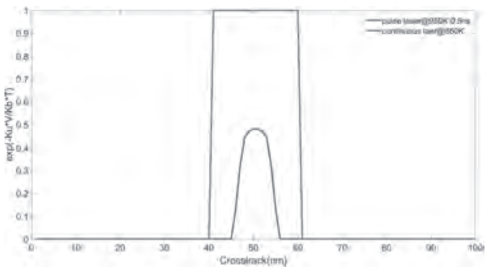

Fig2. Averaged thermal activation of pulsed laser and continuous laser along cross-track direction.

IOB-11. Skew Angle Estimation and Alleviation Based Multi-Layer Perceptron in V-Shaped Read-Head Array BPMR Systems. *K. Fatika*[1], S. Koonkarnkhai[2], P. Kovintavewat[2] and C. Warisarn[1] *1. College of Advanced Manufacturing Innovation, King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand; 2. Nakhon Pathom Rajabhat University, Nakhon Pathom, Thailand*

Attaining high areal density (AD) in bit-patterned magnetic recording (BPMR) technology means reducing its bit period and track pitch [1,2]. When the readers move from the initial to other zones of the disk, a skew angle (SA) takes place, leading to a degradation of the system performance [3]. Therefore, controlling SA properly is necessary. Prior works introduced SA detection along with the suppression [4] and the study of SA in a read-head array [5]. To the best of our knowledge, this is the first proposed scheme of combining a multi-layer perceptron (MLP) with a V-shaped read-head array to estimate and alleviate SA in BPMR. We propose SA estimation and alleviation schemes in BPMR by combining the V-shaped read-head array, as shown in Fig. 1, with MLP. The V-shaped read-head array is investigated in three zones of the disk, i.e., inner, middle, and outer zones, which are notated as ID, MD, and OD, respectively. The initial positions of all three readers in the middle zone are fixed at 5, -5, and 5 degrees for upper, middle, and lower readers, respectively. The sensitivity functions of these readers are shown in Fig. 2, in which their changes as they move from one zone to another are also illustrated. Note that when the sensitivity changes, the channel coefficient, and their readback signals will also change. Therefore, the SA estimation process can utilize readback signals that are produced from the array reader as the input of an MLP-based SA estimator. The next process is attenuating the SA effect in the system by designing an appropriate 2-D equalizer for each SA level in the mentioned zones of the disk, based on a minimum mean-square error approach, before sending an equalized sequence to the Viterbi detector. We found that five levels of estimated SA to signal-to-noise (SNR) values, by using a V-shaped read-head array in BPMR, can estimate nearly 100% of the SA value equal to 0 degree, while the positive and negative SA values also gain high percentages. Furthermore, the accuracy percentage of our proposed scheme is independent to SNR.

[1] Y. Shiroishi et al., IEEE Trans. Magn., vol. 45, no. 10, pp. 3816-3822, 2009. [2] H. J. Richter et al., IEEE Trans. Magn., vol. 42, no. 10, pp. 2255–2260, 2006. [3] M. R. Elidrissi, K. Sann Chan, S. Greaves, et al., Journal of Applied Physics, 115(17), 2014. [4] S. Koonkarnkhai, C. Warisarn, and P. Kovintavewat, AIP Advances 11, 015229, 2021. [5] E. Hwang, T. Oenning, G. Matthew, et al., IEEE Trans. Magn., vol. 51, no. 4, 2015.

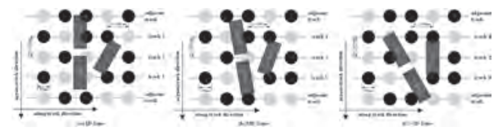

Fig. 1. V-shaped read-head array in various zones.

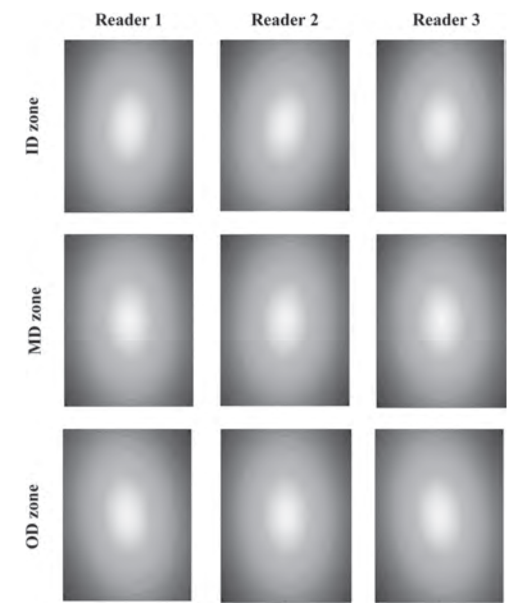

Fig. 2. Reader sensitivity functions in various zones.

IOB-12. Trajectory Sampling Method for Reaction Rate Computation in Micromagnetic Simulations. *X. Wang*[1], J. Duan[1] and V. Lomakin[1] *1. ECE, UCSD, La Jolla, CA, United States*

Trajectory sampling methods can provide important information about thermally-driven statistical properties of micromagnetic systems. Transition state theory (TST) describes reaction rates based on the reaction coordinate in energy phase space [1] but has limitations. Transition path sampling (TPS) [2] and later transition interface sampling (TIS) [3] methods were developed assuming that the system is at a stable state and reaction rate does not change over time. Based on TIS, forward flux sampling (FFS) method was presented by replacing the Monte Carlo trajectory sampling method used in TIS by a direct Langevin simulation that is only forward in time, which eliminates reversable symmetry limitation [4, 5]. Here, a modification of the FFS method, referred to as trajectory sampling method (TW-FFS) is introduced. In FFS simulation, the computation stage is divided into the initial reaction rate computation stage and the following ratio computation stages. For the initial reaction rate computation stage, original method presented in FFS suffers from the parameter tuning problems, which may significantly affect the accuracy, stability, and efficiency of the FFS algorithm. The presented approach combines the above two stages together in a time-weighted manner leading a more stable, accurate and efficient algorithm behavior in micromagnetic simulations. From Fig. 1, TW-FFS gives a much better tolerance in terms of the choice of the initial flux interface as well as provides significantly more accurate results.