MMM 2022 Conference

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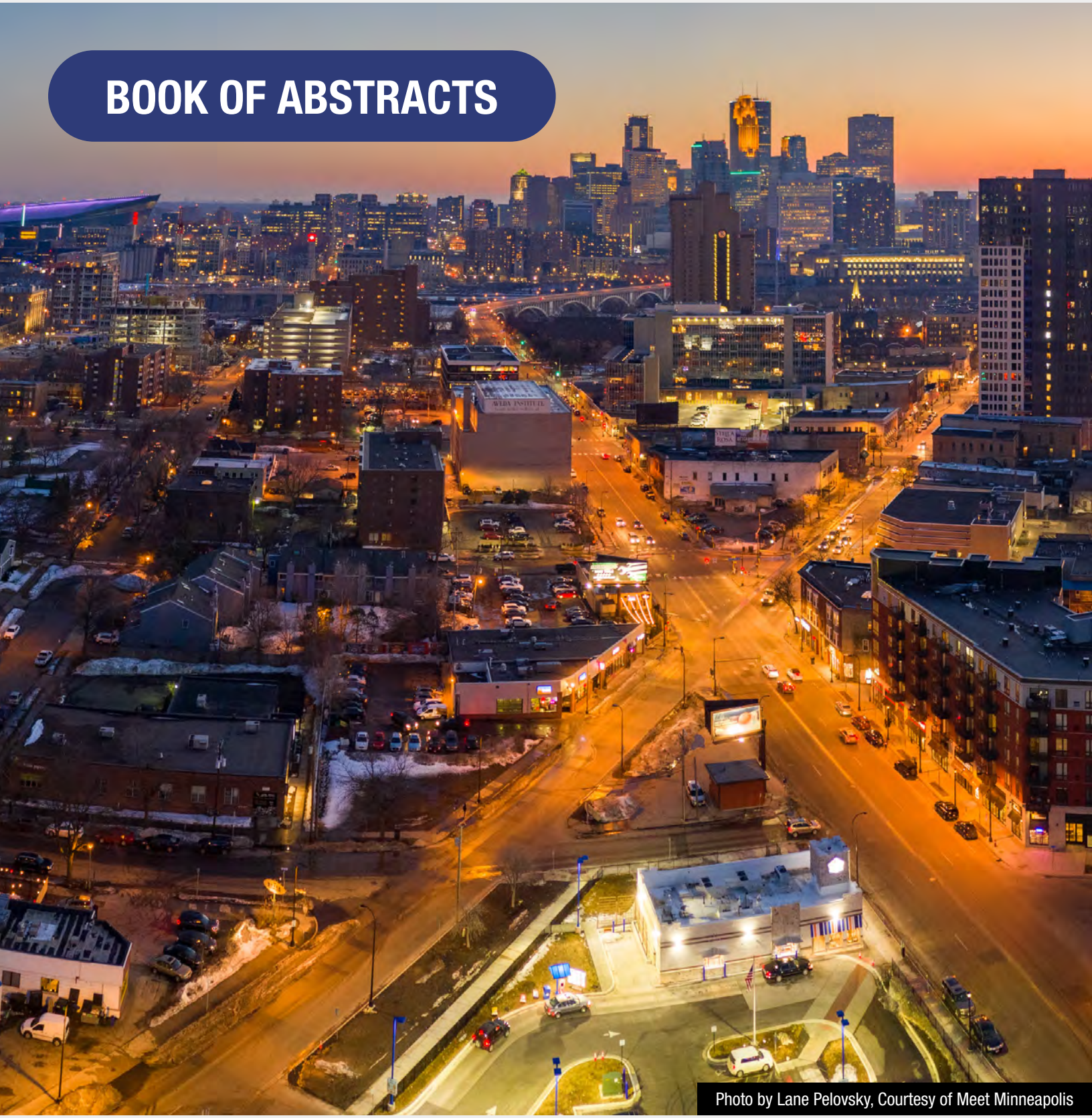
BOOK OF ABSTRACTS



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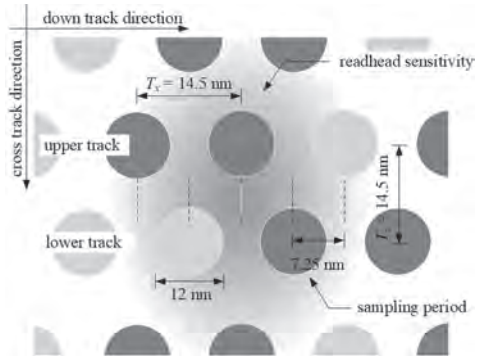

Fig. 1. Configuration of the proposed DTR systems at AD = 3.0 Tb/in² under the readhead sensitivity response that is positioned between the desired upper and lower tracks.

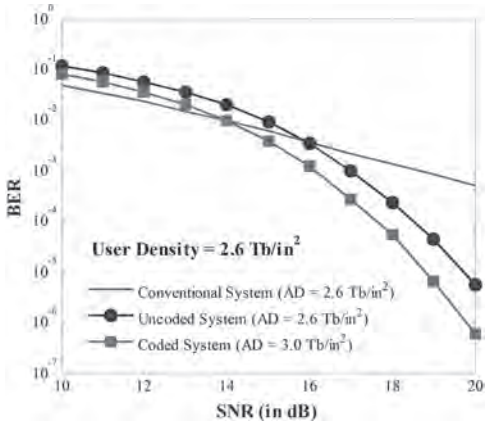

Fig. 2. Performance comparison of various systems at UD = 2.6 Tb/in².

IOB-07. Double-Layer Magnetic Recording with Multilayer Perceptron Decoder for Single-Reader/Two-Track Reading in BPMR Systems. *N. Rueangnetr*[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*

The distance between islands must be reduced to increase an areal density (AD) in bit-patterned media recording (BPMR) [1]-[2], which means both inter-symbol interference (ISI) and inter-track interference (ITI) effects are avoidably increased. Therefore, BPMR system performance is effortlessly degraded [3]. In prior work [4], constrained code working with a multilayer perceptron (MLP) decoder in a staggered-array BPMR system was proposed. However, to get more improvement in the overall system performance of the magnetic recording system, we propose to apply the three-dimensional (3-D) magnetic recording that has double recording layers [5] with the constrained code performing with the MLP decoder. Here, a double recording layer medium is designed as a staggered pattern as shown in Fig. 1. Each layer is arranged as a regular array. Both of them are then arranged in a staggered pattern. The proposed double recording layer not only avoids the significant signal degradation from inter-layer interference (ILI) but also mitigates ISI and ITI effects. An input sequence, $u_k \in \{\pm 1\}$, is encoded by LDPC code and the rate-3/5 constrained encoder to obtain two encoded data sequences, $[x_{k,0}, x_{k,1}]$ as shown in Fig. 2. The odd, $x_{k,0}$, and even, $x_{k,1}$, data sequences are recorded in the upper and lower layers, respectively. A single reader is always positioned between two desirable tracks to retrieve the readback signal, which is then oversampled at time $t = kT_x/2$ to obtain a data sequence, r_k, where T_x is a bit period. The 1-D equalizer and 1-D modified-soft output Viterbi algorithm (m-SOVA) are used to equalize and determine a log-likelihood ratio (LLR), λ_k, respectively. Then, it is decoded and produced the improved LLR values, respectively, with the rate-3/5 decoder and LLR estimator based on MLP, λ''_k. Finally, the estimated user bit, $\hat{u}_k$, is produced using an LDPC decoder. Simulation results indicate that, at the same user density (UD), the proposed system (AD = 5 Tb/in²) provides BER performance over the previous system [4].

Y. Shiroishi et al., IEEE Trans. Magn., vol. 45, pp. 3816-3822 (2009) R. L. White, R. M. H. New, and R. F. W. Pease, IEEE Trans. Magn., pp. 990-995 (1997) P. W. Nutter et al., IEEE Trans. Magn., vol. 41, pp. 3214-3216 (2005) N. Rueangnetr et al., 19th ECTI-CON 2022, pp. 1-4 (2022) Y. Nakamura et al., IEEE Trans. Magn., vol. 58, pp. 1-5 (2022)

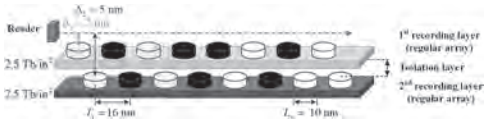

Fig. 1. Cross-section of head-media geometry for double recording layer medium.

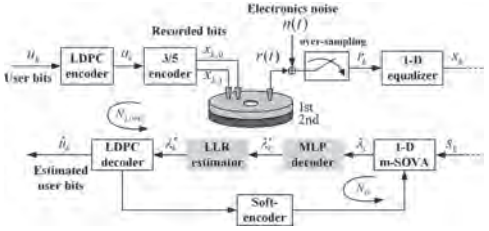

Fig. 2. A code BPMR channel model with the rate-3/5 constrained code.

IOB-08. A Study of Bit Island Spacing Optimization of Staggered Patterned Media-based SRTR Scheme in BPMR Systems. *M. Mattayakan*[1], S. Koonkarnkhai[2], P. Kovintavewat[2] and C. Warisarn[1] *1. King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand; 2. Nakhon Pathom Rajabhat University, Nakhon Pathom, Thailand*

Many promising recording technologies have been introduced for hard disk drives to increase an areal density (AD), this paper considers the bit-patterned magnetic recording (BPMR) technology because it can achieve AD beyond 4 Tb/in² [1]. To increase an AD in BPMR, which unavoidably leads to a problem of two-dimensional (2D) interference. To combat this difficulty, several techniques have been proposed based on modulation codes [2] and iterative processing [3]. Additionally, the BPMR system performance can be further enhanced by the proper island placement [4]. In this paper, we propose to optimize the bit-length (T_x) and track pitch (T_z) of BPMR under a single reader/two-track reading (SRTR) technique, which leads to getting greatly improved BER performance. Here, we arrange the island in a staggered pattern. The single reader was then employed to read both desired data tracks simultaneously. The signal waveforms from the upper and lower tracks, and the readback signal, that correspond to the data bits stored in the staggered medium through our proposed system are illustrated in Fig. 1. Here, we then investigate five cases under an iterative partial response maximum likelihood (PRML) system as follows: Case 1: T_x = 13.0 nm and T_z = 16.2 nm, Case 2: T_x = 14.0 nm and T_z = 15.0 nm, Case 3: T_x = 14.5 nm and T_z = 14.5 nm, Case 4: T_x = 15.0 nm and T_z = 14.0 nm, and Case 5: T_x = 16.2 nm and T_z = 13.0 nm, to obtain AD of 3 Tb/in². Its data samples that were obtained from the over-sampling technique will then be processed through iterative PRML detection. Simulation results indicate that a system that has a larger bit-length distance, T_x, (Case 5) can provide the highest system performance when compared to other cases as shown in Fig. 2. In addition, the proposed system that encountered media noise still provides the highest system performance. It means that choosing proper T_x and T_z spacing can increase the efficiency of the staggered SRTR BPMR system.

[1] M. Mehrmohammadi et al., IOPscience, pp. 1-8 (2010) [2] C. Warisarn, A. Arrayangkool, and P. Kovintavewat, IEICE Trans. Electronics, vol. E98-C, pp. 528-533 (2015) [3] M. Tuchler, R. Koetter, and A. C. Singer,