

Two-dimensional data detection for probe recording on patterned media

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Patterned-media recording comprises one of the possible answers to the question how to guide bit densities beyond the superparamagnetic limit of conventional magnetic recording. In a test setup a matrix of magnetic dots was recorded using an MFM probe [1] and read by scanning the dots (bits) row-by-row with the same MFM device (see for the basic idea Fig. 1A). For a perpendicularly magnetized medium without soft underlayer (SUL) the MFM read signal of a single bit looked rather similar to the bit response of a GMR head [2], including the overshoot which, for instance, is also visible in the response of the 9th bit in Fig. 1B.

In order to combat the pulse's overshoot having degraded the bit detection reliability, geometric constraints can be imposed to the 2-dimensional bit pattern to be recorded. Using a computer simulation for calculation of the MFM response and bit detection, the introduction of particular dot positions with fixed 0 and 1 bits has been investigated, leaving a reduced number of free positions for 'user bits' (see Fig. 1C-D for two different implementations). The program offers facilities for incorporating the effects of bit-position jitter, amplitude noise and clocking offset.

The analysis was performed for a 126 x 126 square bit arrangement. For an elementary read pulse showing 15% overshoot and errorless bit detection, the maximum areal bit-density could be increased by 8.5% and 42% for the both configurations of Fig. 1C-D at the cost of redundancies of 22% and 33%, respectively.

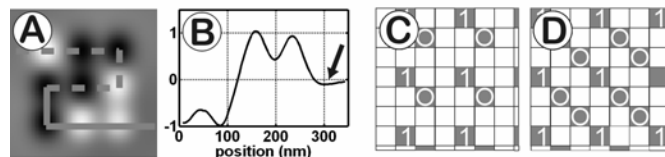


Fig. 1

- A MFM response of a medium with 9 dots
- B MFM output after scanning the third row
- C-D Bit layouts showing 'occupied' positions, resulting in redundancies 2/9 (C) and 3/9 (D)

[1] T. Onoue, M. H. Siekman, L. Abelman, and J. C. Lodder "Probe recording on CoNi/Pt multilayered thin films by using an MFM tip", *J. Magn. Magn. Mater.*, vol. 272-276, pp 2317-2318, 2004.

[2] P.W. Nutter, D.McA. McKirdy, B.K. Middleton, D.T. Wilton, H.A. Shute "Effect of island geometry on the replay signal in patterned media storage", *IEEE Trans. Magn.*, vol. 40, pp 3551-3558, Nov. 2004.