CT07

Roughening Exponent of Domain Interface in CoFe/Pt Multilayers with Varying the Number of Bilayers

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The formation of interfaces and surfaces is influenced by a large number of factors. Nevertheless many scientists expect that a small number of basic 'laws' determine the morphology and the growth dynamics [1]. This belief has been presumed to explain the creep phenomena of the magnetic domain wall (MDW) under a small magnetic field [2]. In the theory, the creep criticality is closely related with the MDW roughening exponent 'α'. Here we examine the roughening exponent in CoFe/Pt multilayers, by use of magneto-optical Kerr effect microscope. The MDW roughness is found to be very sensitive to the number of bilayers 'n' as visualized in Fig. 1(a). It is possibly ascribed to the dipolar interaction and the layer-to-layer coupling from other interfaces. Thousands of images are analyzed based on the scaling function $C(L) \equiv \langle [h(x+L)-h(x)]^2 \rangle_x \propto L^{2\alpha}$, where x and L denote the lateral positions and h is the MDW height, as shown in Fig. 1(b). The quantitative analysis with respect to the number of bilayers will be discussed.

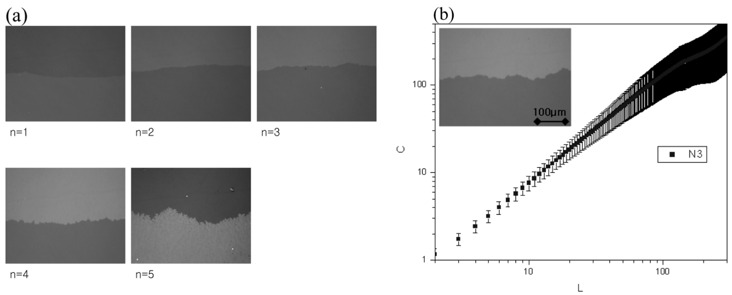

Fig. 1. (a) Magnetic Domain interface images with different bilayer number n of CoFe/Pt. (b) Roughness exponent plot using 404 sequential images of N3.

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CT08

On the Error Calibration of Magnetometer using Nonlinear Integrated Filter Model with Inertial Sensors

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Magnetometer is one of the essential sensors for the aided navigation system, which can provide non-accumulative bearing angle information. But, the inherent error sources of magnetometer such as hard iron effect, soft iron effect, and initial heading error often yield degraded sensor performance. In particular, its application to navigation system significantly affects vehicle's position and attitude information since error is accumulated as time increases. To mitigate error effects from magnetometer, several calibration methods have been investigated. For instance, swinging sensor body frame can be used for the estimation of output vector distortion, which is hardly allowed for the in-flight vehicle application [1]. Instead, real-time error calibration through a nonlinear two step estimator by Standard University or a 14 state extended Kalman filter by Beijing University can be referred to as the significant achievement in terms of the enhanced calibration [2, 3].

In this background, this paper newly presents an integrated filter system containing low graded inertial sensors and magnetometer for the magnetometer's error calibration. The proposed method provides more robust model and algorithm for error calibration than the previous sub-optimal nonlinear estimation algorithm, i.e., extended Kalman filter [4]. Assuming large initial errors, simulation results demonstrate the proposed method provides better accuracy in error calibration.

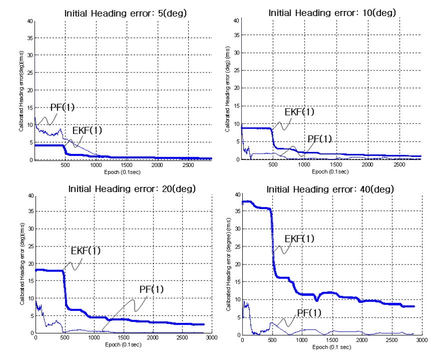

Fig. 1. Error estimation performance.

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