A Feasibility Test for Indoor Magnetic Field Prediction

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ABSTRACT

We examine feasibility for indoor magnetic field prediction based on generic information regarding building structure, which includes a blueprint for determining quantities, sizes, shapes, and locations of reinforcing bars (or I-beams) and floor plan. Without measuring indoor magnetic field, such information may be sufficient to generate indoor magnetic map. We test this possibility by looking into two different types of construction: rebar and I-beam building. A simple prism model is utilized to estimate magnetic field due to any given magnetic building material. The model, however, requires intensity and direction of magnetization for the given material, which limits the predictability of our approach. First, we assumed that the magnetization direction of building materials is uniform and parallel with the Earth field. Comparison between the predicted and measured magnetic fields for two buildings showed insignificant similarity, suggesting that the building materials would have their own direction of magnetization. This was confirmed by measuring magnetic fields over a rebar and two I-beams of 1-m length at magnetically quiet outdoor environment. The estimated intensities decrease with the total weight of the measured materials, while the estimated directions become more parallel with the Earth field. In order to examine a role of magnetization direction in indoor magnetic field, we divide the walls, floor, and ceiling of the measured space into numerous blocks and invert the measured data for the intensity and direction of magnetization of each block. The misfits between the modeled and observed magnetic field decrease faster by using more blocks for the walls than by using similar considerations for the floor and ceiling. The recovered direction of magnetization shows vertically oriented inclinations and randomly distributed declinations, which complicates prediction processes. Finally, we discuss the extent of predictability and ways to improve the modeling process.

KEYWORDS: Indoor magnetic map, magnetic field prediction, forward and inverse modeling