Suppression of Moiré Fringes Induced by Metal Meshes for Touch Screen Panels

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For touch screen panels (TSPs), high-transparency indium-tin-oxide (ITO) has been widely used as a sensing electrode. In recent years, metal films such as silver (Ag) and copper (Cu) exhibiting lower price, higher electrical conductivity, and superior durability attract much attention for medium and large TSPs [1]. To ensure the optical transmittance (>85%) of TSPs, however, those metals must be patterned with the width of less than 5μm. If the metal grid width should be large (~10μm) enough to ensure the electrical conductivity, the moiré fringes are inevitably generated owing to the interference between the metal grid of TSPs and a black matrix (BM) in display panels. With attempt to eliminate such moiré fringes, we have designed horseshoe-shaped metal meshes in the presence of the typical BM structure used in a S-IPS panel (Fig. 1(a)). Using a ray tracing technique [2], we investigate the dependence of the moiré effect on the crossing angles between TSPs and display panels. For comparison, we have performed simulations with rectangular and random metal meshes. They are designed to have the same grid width (10μm) and aperture ratio. We have used 10 million rays and divided the receiver into 160 × 160 cells (bins) to obtain high-quality moiré fringes. As seen in Fig. 1(b), strong moiré fringes are visible to the naked eye when the rectangular metal mesh is superimposed on the BM at low crossing angles. In contrast, the horseshoe-shaped metal mesh brings in very weak moiré patterns at the same crossing angle (Fig. 1(c)). Similar results are also observed with a random metal mesh. To quantify the moiré fringes, we have computed the standard deviation (SD) from the ray distribution as a function of the crossing angle and presented the results in Fig. 1(d). Compared with the rectangular metal grid, the available range of crossing angles where the SD value reaches a flat bottom becomes broader by the horseshoe-shaped metal grid. Within some range of crossing angles, the random metal grid shows even higher SD value due to point defects, compared with the other metal grids.

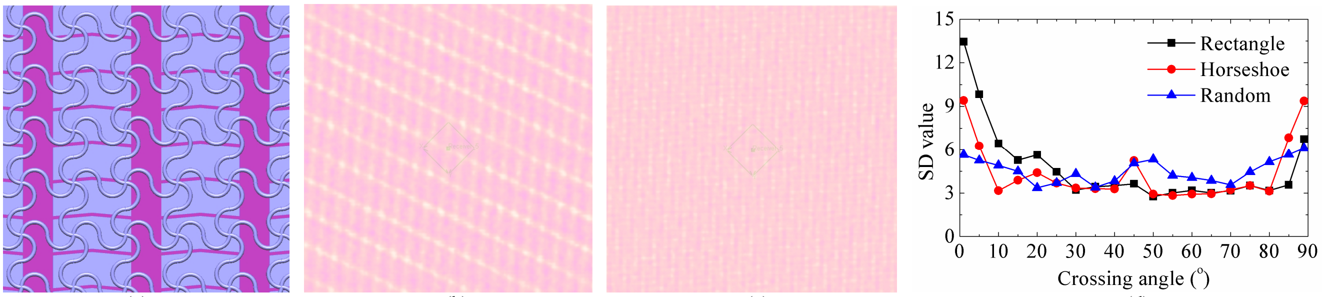

Fig. 1. (a) Overlap image of the horseshoe-shaped metal grid and the BM used in a S-IPS panel, simulation results of moiré patterns induced by the (b) rectangular and (c) horseshoe-shaped metal grids at the crossing angle of 1, and (d) calculated SD value as a function of the crossing angle for different metal grids.

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References

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