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Model refinement for fracture failure prediction of smartphone LCD with unrecognized blind uncertainty

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Abstract

The role of virtual testing has ever been increased during product development, in particular, at the stage of design and evaluation. However, it is still challenging to build a highly accurate computational model that emulates the behavior of a real product. Unrecognized blind uncertainty is often incorporated, which gives invalid prediction results, even after calibration of simulation models using experimental data. This paper addresses the problem of unrecognized uncertainty in an invalid simulation model in smartphone liquid crystal displays (LCD) fracture analysis. The study proposes a systematic approach for the model refinement under the condition that the calibrated model is invalid. First, potential causes of blind uncertainty is identified through brainstorming. Next, possible candidates is determined in conjunction with the issues identified from brainstorming. Finally, the effect of employing potential candidates on removing the blind uncertainty is quantified. The most significant candidates are determined using the weighted decision matrix. It is demonstrated that the model refinement process enhances the prediction capability of the smartphone LCD fracture failure in the design domain by minimizing the effect of the unrecognized blind uncertainty. It is proved in the smartphone case study that the proposed model refinement substantially improved the degree of the model validity from 0.001 % to 61.2 %.