

TV packaging optimization of the frontal drop impact using equivalent static loads

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Abstract

In electronic industries, packaging designs for protection are very important because electronic products are easily damaged in distribution. While distributing products, drop impacts are mainly issues. To protect electronic products, buffer materials like Expandable Poly-Styrene (EPS), and Expandable Poly-Propylene (EPP) are used in packaging. Therefore, packaging designers are effort to develop packaging design for improvement of product protection as well as reduction of the packaging size, and weight. These conditions should be considered as an objective functions or design constraints when optimizing a packaging design. However, it is difficult to apply gradient-based optimization methods to impact optimization problems because of the large nonlinearity of the problems which should be considered in the time domain. Although the capability of the computer has been developed and numerical algorithms have been advanced, drop impact optimization is still quite difficult owing to high non-linearity and numerical cost. The equivalent static loads method for non-linear static response structural optimization (ESLSO) has been developed for such nonlinear dynamic response structural optimization. equivalent static loads (ESLs) are linear static loads which generate the same displacement in the linear static analysis as those of the nonlinear dynamic analysis at a certain time step. Nonlinear analysis and linear static response optimization using ESLs are carried out sequentially until the convergence criteria are satisfied. A new ESLSO method is proposed for TV packaging shape optimization and is verified using a practical example. Design optimization of TV packaging is carried out to minimize weight packaging. The glass panel in TV is the most important part and design constraints are composed with it. The shape and size of EPS packaging are optimized. The weight is minimized and the size is optimized while the glass panel is protected in drop impact. The drop test of a TV packaging is analysed by LS-DYNA, and NASTRAN is used for optimization.

Keywords: structural optimization; equivalent static loads (ESLs); shape optimization.