

CADFEM Consulting

Drop Test Simulation of a Cooker Including Foam Packing and Pre-Stressed Plastic Foil Wrapping

Thermal Shrinkage with Prestressing, Dynamic Impact, Deformation of Cooker and Package

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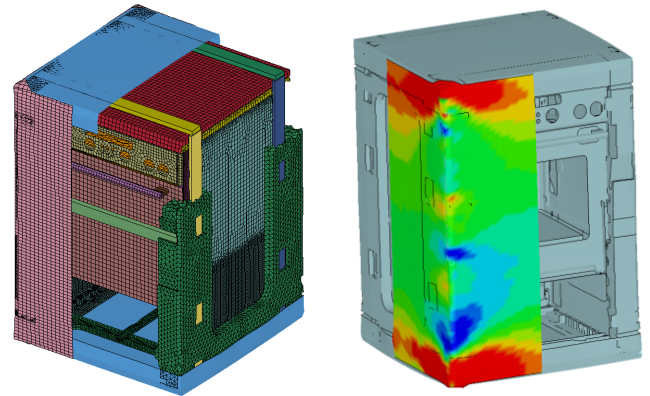
Simulation Task

Unfortunately it is common for consumer products to be subjected to mechanical shock loading, particularly those ones associated with being dropped during transportation or delivery. The ability to withstand such loading situation is crucial for the design of a successful product like those of Bosch-Siemens-Hausgeräte. In that view, a properly designed package can mitigate the potentially damaging vibration input, filtering its effects from the product protected within. In order to pack and seal goods, foam based materials are typically used in addition with plastic shrink wrap in many industries. In the design of a successful product it is not only important to know how the design of components is affecting the packaging system but also vice versa.

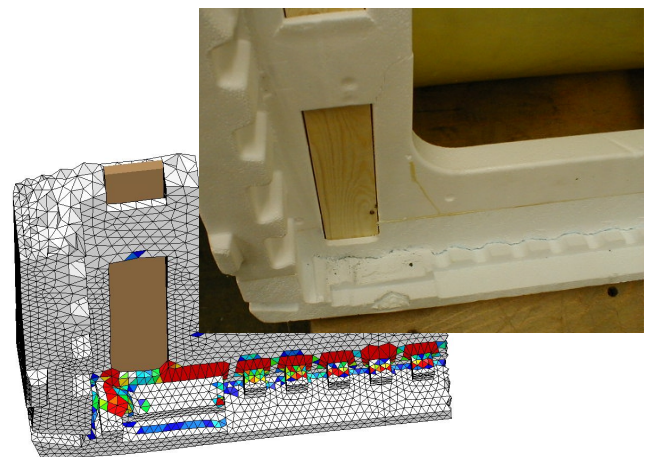
Pre-stressing due to the plastic shrink wrap (thermal shrinkage) is also very important and has to be taken into account before a numerical drop test is done.

Solution Method and Result

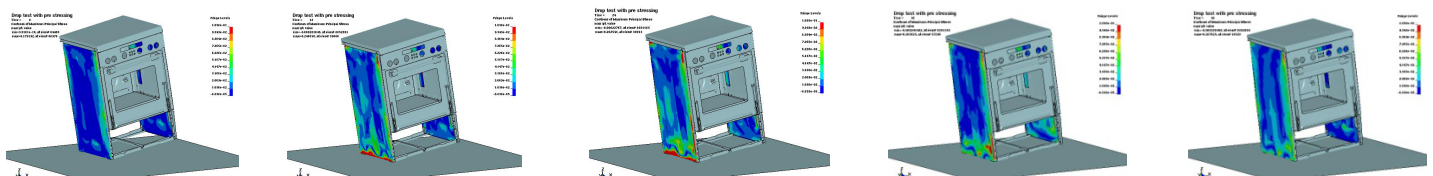
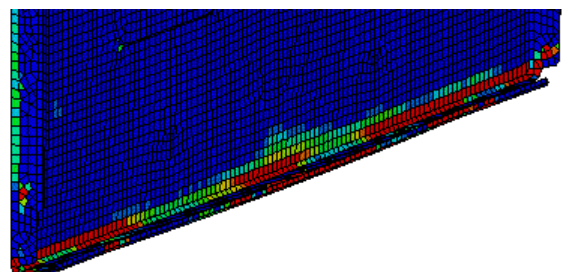
The present work deals with the numerical simulation of a drop test of a cooker including packaging foam and plastic foil wrapping. Additionally the pre-stressing of cooker and packaging due to thermal shrinkage of the plastic foil has been taken into account in the numerical investigation. For this, a thermal pre-stressing simulation of the plastic wrapping has been included before the actual drop test of the whole assembly has been conducted. The permanent deformations of the cooker nearby the impacted edge as well as the deformation of package foam in the vicinity of the impacted edge were the primary areas of interest and compared with experimental data. LS-DYNA was used to perform the drop test simulation of the cooker as well as the thermal pre-stress simulation of the plastic wrapping. The simulation results are in good agreement with the experimental drop test results. The foundation for an optimized procedure for product/package design has been achieved.



FE-model and thermal load case: Shrinkage of plastic foil wrap



1. Principal strain in packing material and failure experiment



Figures Courtesy of Bosch-Siemens-Hausgeräte GmbH, Traunreut, Germany