Chakrit Suvanjumrat 2009: Computer Simulation Method for Drop Test of Liquid-Filled Plastic Containers Using Finite Element Method. Doctor of Engineering (Mechanical Engineering), Major Field: Mechanical Engineering, Department of Mechanical Engineering. Thesis Advisor: Mr. Tumrong Puttapitukporn, Ph.D. 103 pages.

The Computer-Aided Design (CAD) and Computer-Aided Engineering (CAE) in cooperated with Finite Element Analysis (FEA) method are the engineering method that plays an important role in designing of many products of the manufacturing industries. In manufacturing of plastic bottle industries, this method can perform to analyze strength of bottles before manufacture and test under drop test standard. This research was focus on the study of impact effects of liquid-filled plastic bottles, made from Polyethylene Terephthalate (PET), under the ASTM D2463 drop test standard using both experiments and the finite element code MSC/DYTRAN. In FEA, the fluid–structure interaction (FSI) algorithms used to specify appropriate boundary conditions were studied and evaluated their computational times and accuracies. The new mathematical equation, known as the flow stress model (σ_{f-STP}) to describe the relationship between hardening stresses and strain rates, was proposed. Additionally, the new failure criterion to determine the failure height under the drop test standard was developed. In our simulations, plastic bottles were filled with water to the full and half capacities. Then, they were released from three different heights (0.5, 1.0, 1.5 m) to determine impact forces and strains on the surface of bottle. With Coupling Lagrangian Eulerian (CLE) and proposed flow stress model, we found that impact forces and failure heights obtained from FEA yielded the accurate and acceptable results. The percent error of impact forces was less than 11.49%. The percent error of failure heights was less than 9.27%.

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