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Thermodynamical Approach Using the Explicit Dynamic Finite Element for the Simulation of Thermoforming and Blowmolding Processes

F. Erchiqui
Université du québec en Abitibi-témiscamingue
445, boul. de l'Université, Rouyn-Noranda (Québec) J9X 5E4

The problem of modelling and the dynamic element simulation of thermoforming and blow molding processes for viscoelastic sheet are considered. To take account of the enclosed gas volume, responsible for inflation of the thermoplastic membrane, which contributes significantly to the strength and stiffness of a thermoplastic structure, we considered thermodynamical approach to express external work in term of a closed volume. The pressure load is thus deduced from the thermodynamic law of ideal gases. The viscoelastic behaviour of the K-BKZ model is considered. The lagrangian formulation together with the assumption of the membrane theory is used in the finite element implementation. The numerical validation is performed by comparing the theoretical free inflation with numerical results. Moreover, the influence of the K-BKZ constitutive model on the thickness and stress distribution in the thermoforming of containers is presented.