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Monday, 12 June 2006

Professor Martin Zatloukal
Tomas Bata University in Zlin
Faculty of Technology, Polymer Centre
Czech Republic

Subject: Review comments on the Bachelor thesis of Roman Kolarik, "Modeling of the Film Blowing Process by using Variational Principles"

Dear Professor Zatloukal,

It was my pleasure to review the bachelor thesis of one of your students. My review comments are attached below. I would grade the thesis as excellent and hope the student has plans to continue into graduate school!

Sincerely,

Harry Mavridis, Ph.D.
Consulting Researcher

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Review comments on the Bachelor thesis of Roman Kolarik, "*Modeling of the Film Blowing Process by using Variational Principles*"

This is an ambitious thesis, tackling a problem of practical and theoretical significance. The writing is rather good, especially for an undergraduate writing in a foreign language. The form and content of the thesis are also excellent, combining background, theory and experiments. All the more impressive is that this is a bachelor thesis and it should set a high standard for others to follow.

The present reviewer would like, however, to make certain comments, particularly about some technical details of the thesis, perhaps as suggestions for future work:

1. While the background and experimental sections are comprehensive, the main contributions of the thesis are two:
    a. Fitting bubble shapes of linear and branched mLLDPE with the Zatloukal & Vlcek model
    b. Attempting a stability analysis of blown film with the Zatloukal & Vlcek model
2. Regarding (1a), it would be of interest to analyze the fitting results and make some conclusions and/or generalizations. The shapes of the bubbles for linear and branched mLLDPE appear different and the Zatloukal & Vlcek model seems to capture that. What parameter characterizes the bubble shape – is it $p \cdot J/R_o$? Do branched materials have a lower $p \cdot J/R_o$? What does this mean physically?
3. Regarding (1b), the assumptions involved, as listed on page 37, are rather severe (isothermal, Newtonian fluid). What's more, blown film stability of an isothermal Newtonian fluid must have been studied in the literature (the work of Petrie and Cain&Denn come to mind). How do the results of the present work differ from literature analysis?
4. A novelty in the stability analysis of the present work is that it goes beyond the "standard" stability analysis of the governing equations and it also considers physically limiting criteria, such as maximum tensile and/or hoop stress (for "machine stress stability contour" and "circumference stability contour", respectively). Here too, comparison with the predictions of the standard Newtonian, isothermal model would be appropriate.
5. As a general comment on the stability contours versus BUR: the BUR in practice is typically less than 5 and in the vast majority of cases it is in the range of 1.8 to 3.5. For the thickness ratio H_1/H_o, it typically is 0.005-0.025 for linear LLDPE and up to 0.05 for branched LLDPE.
6. Most practical stability problems in blown film involve output rate as well. In other words, BUR and thickness ratio are not enough to characterize the problem – output rate is significant. In many practical cases a polymer will make film at stable conditions at a given BUR, thickness ratio and output rate and become unstable at a higher output rate.