UNIVERSITY OF WALES

INSTITUTE OF NON-NEWTONIAN FLUID MECHANICS

PROCESS MODELLING
25 - 27 MARCH 2002

PROGRAMME

Monday 25 March - Afternoon

12:00 Registration and Lunch

Session 1 *Chairman: K Walters*

14:15 - 14:55 H M Laun
Viscoelastic FEM simulations in an industrial polymer research laboratory

14:55 - 15:35 J C Hyun
Nonlinear dynamics and a stabilization of film casting process

15:35 - 16:00 Coffee/Tea

Session 2 *Chairman: P Rh Williams*

16:00 - 16:40 F P T Baaijens
Numerical analysis of flow mark surface defects in injection molding flow

16:40 - 17:10 F T Pinho
Non-Newtonian fluid mechanics and computational rheology at the Universities of Porto and Beira Interior, Portugal

17:10 - 17:30 P J Oliveira
Developments in finite volume methods applied to computational rheology

17:30 - 17:50 S S Edussuriya
Towards a viscoelastic model of the encapsulation process in flip-chip packaging

19:30 Dinner

DEVELOPMENTS IN FINITE VOLUME METHODS APPLIED TO COMPUTATIONAL RHEOLOGY

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Many of the existing methods to solve numerically problems involving the flow of viscoelastic fluids are of the finite element type. In recent years a tendency has emerged for the application of finite volume methods in this area. However, many of these finite volume methods are of restricted applicability in that the computational meshes have to be orthogonal, with a staggered variable arrangement, and the differencing schemes often are of first-order accuracy only.

In this communication, we will report on our experience with a general, collocated finite-volume method for the simulation of steady and unsteady viscoelastic flows, and for various rheological models: upper-convected Maxwell or Oldroyd-B type; Phan-Thien and Tanner; and FENE-CR. Some details of the numerical procedure will be given, in particular of the special procedure developed to avoid velocity/stress decoupling in non-staggered meshes. Emphàsis is also placed on the use of high-resolution schemes to represent the convective terms in the constitutive equations, and the consequent gain in numerical accuracy. The influence of high resolution schemes on iterative convergence is also addressed. A number of examples will be given, encompassing entry flows, flows through plane sudden contractions, steady flows past confined circular cylinders, and vortex shedding.