CHAPTER IV
CONCLUSIONS

The results of our work can be summarized as follows:

1. Several flow regimes were identified according to extrudate skins for the HDPE/PP blends. For HDPE-rich blends, there is an oscillating regime where the piston load required to maintain a constant speed fluctuates. The onset of the oscillation regime marks a transition from a steady state flow to an oscillating flow which we identify as a ***Hopf bifurcation***. Since the onset and the terminal point of the oscillation regime are path dependent and the severity of the jump in stress, it is concluded that the bifurcation is ***subcritical***.

2. The load wavelength and the skin wavelength are inversely proportional to the amount of material remaining in the barrel. The wavelength ratio depends on both strain rate and blend composition.

3. The slip velocity varies linearly with the apparent strain rate corrected for slip for all the blend samples. For the HDPE-rich blends, the slip velocity can occur even at the small amounts of strain rate. This is due to a gradual disentanglement of polymer chains at the capillary wall. For the PP-rich blends, the slip velocity can be observed only when the strain rate or the wall shear stress has reached a critical value.

4. The extrapolation length (b) is found to be independent of the strain rate and the slip velocity in the case of HDPE-rich blends. The extrapolation length varies nearly with the apparent strain rate or the slip velocity until reaching its

asymptotic value for the case of PP-rich blends. The behavior of the former case corresponds to the Rouse regime and the latter case is the marginal regime, consistent with the conjecture of Brochard and de Gennes. The asymptotic extrapolation length is smaller for a blend with a larger PP content. This is because PP can hinder disentanglement within the HDPE matrix; PP shields the stress transfer process. Another possible explanation for the reduced slippage at the wall is because a partial slipping has taken place between the two immiscible phases.

5. The recoverable shear S_R (the wall shear stress normalized by the glassy storage modulus) for both the onset of the oscillation regime and the melt fracture is found to vary between 0.1 - 0.14, indicating that the origins of both the oscillating regime and the melt fracture are the same or intimately connected.