Flow and Failure in Extension of Monodisperse Polymer Melts
It is well known that failure or rupture phenomenon appears in the extension of polymer melts. These appear not only as failure in extension rheometers, but also as sharkskin, developments of holes in thin polymeric films etc. Sometime these ruptures appear spontaneous as well. The rupture is commonly referred to be of either brittle (e.g. cohesive type) or of liquid (e.g. necking type) nature. Here the focus will be on monodisperse polymers, to study numerically the sample flow dynamics in dual wind-up extensional rheometers. The computations are within the ideas of the microstructural 'interchain pressure' theory based on the molecular stress function constitutive model for the polymer melt flow. The purpose is twofold. Primarily to present to what extent the experimentally observed failure, appearing during or after (e.g. as a spontaneous failure) extension, can be explained within this recent theoretical understandings of polymer fluid dynamics. Secondarily to discuss the consequences of the theoretical/computational appearance of the necking type of failure for the understanding of the cohesive type of failure.