FRAME-INVARIANT MODELING OF SUSPENSION FLOW FOR COMPLEX GEOMETRIES

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Flow in complex geometries generally results in flows of mixed type, meaning the flow has varying ratio of straining to rotation. For microstructured fluids which exhibit non-Newtonian rheology, flow type effects are known to alter both the microstructure and the rheology. The constitutive relation between the stress and velocity gradient for a noncolloidal suspension will be posed in frameinvariant form and employed in the suspension balance approach. The influence of the frame-invariant modeling of the rheology upon particle migration and bulk flow will be examined in relatively simple situations which are previously well-studied, followed by an examination of predictions in complex geometries. The focus in the latter case will be upon the flow through abrupt contractions and expansions of channel flows, with 2:1 and 4:1 ratios of flow widths. For the contraction with uniform conditions at the upstream inlet a short distance from the contraction, particle accumulation to near maximum packing is predicted in the corners upstream of the contraction.