Integral Methods for Flow in a Conical Centrifuge

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A set of through-thickness averaged equations for momentum and strain rate are derived for the problem of axi-symmetric free-surface flow within a spinning cone. The expressions are independent of the choice of constitutive law and can therefore be used for modeling the flow of a variety of materials within an industrial conical centrifuge. By assuming a through-thickness velocity profile the distribution of flow thickness and average velocity over the internal surface of the cone can be obtained. The approach has been validated for thin Newtonian viscous flow by comparison with full three-dimensional solutions of the Navier?Stokes equations obtained with a commercial CFD package. The averaged equations provide an accurate prediction of the flow thickness, velocity and the length of the zones of influence of inlet and outlet boundary conditions.

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