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STUDY ON THE EFFECTS OF SPACER GEOMETRY IN MEMBRANE FEED CHANNELS USING THREE-DIMENSIONAL COMPUTATIONAL FLOW MODELLING

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Abstract:
Three-dimensional computational fluid dynamics (CFD) study is carried out for spacer-obstructed feed channels of membrane elements using Finite Volume package FLUENT. The fluid flow behaviour is studied by varying geometric parameters of diamond and parallel type spacers. The velocity profiles and hence the average shear stress values significantly depend on the parameters such as transverse filament spacing and filament thickness whereas the effect of axial filament spacing in altering the velocity profiles and shear rates is not that significant. The effect of spacer filament thickness is more pronounced on pressure drop as compared to the effect of spacing between the filaments. The local and average shear stress values also depend on the flow attack angle. When filament spacings and flow attack angles are small, the average shear stress values are high. The shear stress distribution is more uniform in diamond spacers when the flow attack angle is high and in parallel spacers when transverse filament thickness is small. The spacer dimensions can cause unsteadiness in flow that depends on the channel Reynolds number. The value of critical Reynolds number at which flow becomes unsteady can be as low as 75 when filament spacings and flow attack angles are small and it can be more than 200 for larger flow attack angles.

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