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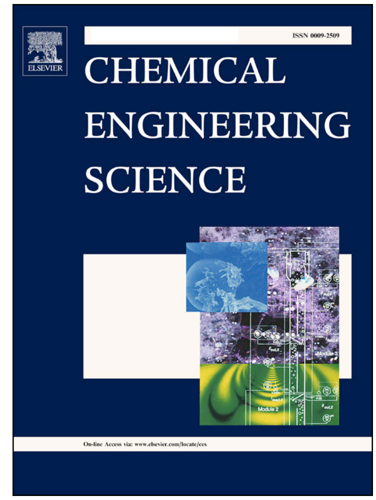

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A new design method for propeller mixers agitating non-Newtonian fluid flow

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Abstract

The common design methods for mixers agitating non-Newtonian fluid flow are not suitable for developing a completely new geometrical shape. These design methods were originally intended only to scale an existing mixer with several correlation methods. For this, the dimensionless power characteristics of the mixer is first determined for agitating Newtonian fluid flow. Subsequently, for the desired operating conditions, the apparent viscosity of the non-Newtonian fluid is derived using the mentioned correlation principles. After setting the desired geometrical parameters, it is possible to calculate the apparent Reynolds number. By comparing the apparent Reynolds number with the dimensionless power characteristics, the estimated power consumption and, therefore, the engine to drive the mixer can be determined. This procedure comes with the assumption of a valid correlation between Newtonian and non-Newtonian fluid flow, which is not physical. Furthermore, the question of how to develop the geometric shape of a mixer for a considered operation point is still open. In this paper, a new method is introduced to develop the shape of a propeller mixer for arbitrary operating conditions in pseudo-plastic fluids by analytical methods. The method is based on the consequently implemented blade element momentum theory.

Keywords: blade element momentum theory, design process, nonnewtonian fluid flow, propeller mixer

1. Introduction

Mixing procedures are widely distributed in many fields of the process industry. These procedures are often applied to agitate non-Newtonian fluid flow. The objective of the mixing process may be versatile, usually depends on the

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