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ANALYSIS AND OPTIMIZATION OF MIXING INSIDE INTERMESHING CO-ROTATING TWIN-SCREW EXTRUDERS

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The main goal of this work is to develop a simulation tool, based on the mapping method, to study distributive mixing inside intermeshing co-rotating twin-screw extruders (TSE's). For mixing analysis, we developed a numerical method to determine the 3D velocity field in TSE's that are characterized by a complex geometry with narrow gap regions and internal moving parts. A new approach to the mapping method, suitable to analyze mixing in 3D geometries with internal moving parts, is introduced. The mapping matrix is calculated in the full 3D fluid domain, using the typical time and space periodicity that characterize TSE's. The mapping matrix is calculated in the full 3D fluid domain, using the typical time and space periodicity that characterize TSE's. The volume-averaged intensity of segregation, weighted with the volume flux, is defined as to measure the mixing states. We applied the newly introduced mapping method to analyze mixing performance in conveying and kneading elements with different staggering angles. We add transition mapping matrices between conveying and mixing elements and vice versa to quantitatively analyze mixing in realistic screw configurations. Especially the difference between sequential conveying and mixing elements and alternating elements are analyzed in some detail.