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A SCALING-UP METHODOLOGY FOR CO-ROTATING TWIN-SCREW EXTRUDERS

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Scaling-up can be seen as a set of rules and/or methods that allow the definition of the operating conditions and/or geometry of a specific equipment that replicate the working conditions of a different machine of the same type, but different size, processing the same material. Scale-up rules are used frequently in the polymer industry to extrapolate to the production plant the settings investigated and optimized in laboratory equipment, thus lowering the development costs. Traditional scale-up rules often consist of simple power-type relations that are derived from analytical expressions describing individual processing stages. For example, this is the case of single screw extrusion. However, the method is unable to take simultaneously into account the various steps of the plasticating sequence and the multiple objective character of the exercise. An alternative approach is to use a methodology based on multi-objective optimization algorithms, where the aim is to define the geometry/operating conditions of the target extruder that minimize the differences between the values of the performance criteria selected to characterize the reference and target extruders. Since methods of scaling-up twin screw extruders are difficult to find, the above methodology was applied to this type of machines. The optimization routine uses the results provided by a numerical modelling routine that takes into account flow and heat transfer along the screw axis, from solids conveying to the die exit. The preliminary results obtained are encouraging.