MODELING THE OPERATING PERFORMANCE OF MELT FILTRATION USING NUMERICAL AND HEURISITC TECHNIQUES

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For designing the polymer filtration and production equipment, the initial pressure drop and the screening performance of the filter must be determined. Several models exist for calculating the initial pressure drop of a woven screen, like models based on Darcy's Law, resistance factors or similarity laws in form of dimensionless numbers.

A general valid analytic equation for the determination of the initial pressure drop of square woven and twilled dutch screens is presented. Therefore numerical CFD simulations were performed in order to create a characteristic curve based on 9.000 data sets as basis for heuristic modeling. A general valid analytic equation named pecScreen was developed by using evolutionary heuristic optimization algorithms based on symbolic regression. A performed error analysis shows that the generated model provides very good results. Coefficients of determination above 0,9994 and mean relative errors less than 7% could be achieved. Figure 1 shows a flow chart of the complete modeling process.

To verify the determined model, experiments at different melt filtration systems from EREMA[b] were conducted using various virgin materials as well as in-house recycling materials, filtration types and filtration fines as well as mass flow rates. It turned out that the results of the general valid analytic equations are in good agreement with the experimental data. The generated model pecScreen provides good results with coefficients of determination R^2 of 0,91 and mean relative errors of 16% compared to other models mentioned above with R^2 of 0,66 and MRE of 29%.
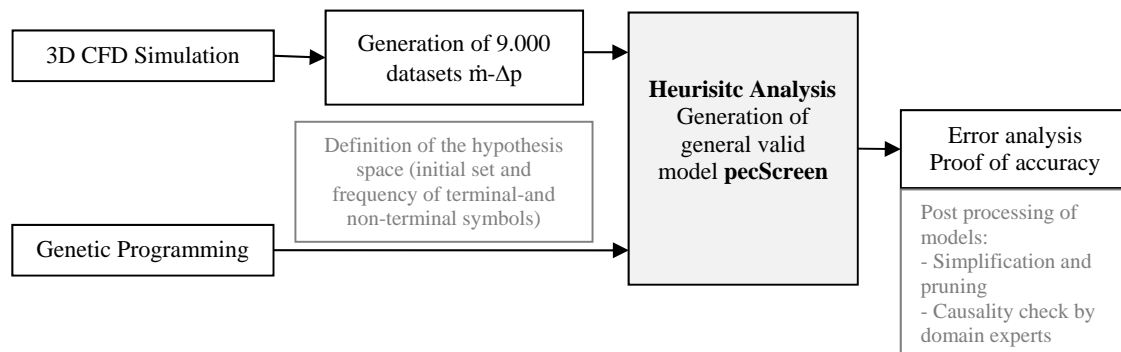

Figure 1: Flow Chart; developing general valid analytic equation for melt filtration