A New Soft Sensor Based on Recursive Partial Least Squares for Online Melt Index Predictions in Grade-Changing HDPE Operations

Abstract

Soft Sensors have been developed through phenomenological, empirical and hybrid modeling for quality variable predictions in various chemical processes. In this work a soft sensor based on an empirical model has been developed for the successful predictions of melt index (MI) in grade-changing polymerization of High Density Polyethylene (HDPE) processes. In order to capture the nonlinearity and grade-changing characteristics of the polymerization process efficiently, a recursive partial least squares (RPLS) update as well as a model bias update is applied to the process data successfully. Two schemes have been proposed: scheme-I and scheme-II. Scheme-I makes use of an arbitrary threshold value which selects one of the two update strategies according to the process requirement at a certain updating instance so as to minimize the relative root mean square error (RMSE). On the other hand, with the aim of preventing excessive RPLS update, scheme-II minimizes the number of RPLS update runs (NPR) while maintaining, increasing or sometimes reducing the RMSE obtained from scheme-I. Proposed schemes are compared with other strategies to exhibit their superiority.