Slovak Society of Chemical Engineering
Institute of Chemical and Environmental Engineering
Slovak University of Technology in Bratislava

PROCEEDINGS

52nd International Conference of the Slovak Society of Chemical Engineering SSCHE 2026

Hotel SOREA TRIGAN
Štrbské Pleso, Slovakia
May 26 - 29, 2026

Editors: Assoc. prof. Mário Mihaľ

ISBN: 978-80-8208-177-3, EAN: 9788082081773

Published by the Faculty of Chemical and Food Technology, Slovak University of Technology in Bratislava in Slovak Chemistry Library for the Institute of Chemical and Environmental Engineering; Radlinského 9, 812 37 Bratislava, 2026

Fáber, R., Ľubušký, K., Paulen, R.: A Simplified Framework for Process Model Development in Industrial Simulation Environments, Editors: Mihaľ, M., In *52nd International Conference of the Slovak Society of Chemical Engineering SSCHE 2026*, Štrbské Pleso, Slovakia, 2026.

A Simplified Framework for Process Model Development in Industrial Simulation Environments

Rastislav Fáber[1], Karol Ľubušký[2], and Radoslav Paulen[1]

[1]*Slovak University of Technology in Bratislava, 812 37 Bratislava, Slovakia*
[2]*Slovnaft, a.s., 824 12 Bratislava, Slovakia*
e-mail: rastislav.faber@stuba.sk

Industrial process systems are inherently complex, and detailed first-principles models or advanced control approaches are often difficult to implement and maintain in practice. This is particularly evident in alkylation units, where strong interactions, unmeasured disturbances, and operational variability limit the applicability of highly detailed models and complicate their long-term use in industrial environments.

This work proposes a framework for process model development based on a reduced set of process variables. The variable selection combines Principal Component Analysis (PCA), Partial Least Squares (PLS), LASSO regression, and stepwise regression to identify relevant variables from the available measurements. These methods are used to evaluate variable importance, collinearity, and contribution to the dominant process variability. The selection is then refined using process knowledge, where variables are assessed with respect to their physical meaning, measurement reliability, and availability in real operation. Variables that are statistically relevant but operationally unreliable or redundant are excluded or replaced by more suitable alternatives.

A steady-state model is constructed in gPROMS ProcessBuilder and AVEVA Process Simulation to represent the main unit operations and their interactions. The model is implemented using predefined process blocks that encapsulate the governing equations, rather than coding the model directly from first principles. The model captures the key process relationships at the unit level and enables systematic analysis of process behavior under varying operating conditions. The simplified structure avoids detailed kinetics and secondary effects, focusing on a stable and interpretable representation of the system.

The model is further used to analyse the influence of the selected variables on the system response and to verify that the reduced variable set is sufficient to describe the dominant system trends without loss of essential process information. The results confirm that the selected variables, together with the simplified model structure, provide a consistent and physically meaningful description of the main process behavior under real industrial constraints.

Key words: Feature selection, Process simulation, Mass-balance modeling.

This work is funded by the Slovak Research and Development Agency under the project APVV-24-0007, and by the Scientific Grant Agency of the Slovak Republic under the grant 1/0263/25. We acknowledge the financial support provided by the European Union through the NextGenerationEU programme under the Recovery and Resilience Plan for Slovakia, projects no. 09I01-03-V05-00002, no. 09I01-03-V04-00024, and the Early Stage Grant no. 09I03-03-V05 (23-04-06-A).