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A new approach to modeling and simulating of mass transfer processes in industrial column apparatuses

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Statement of the Problem: The diffusion boundary theory is not applicable for the modeling of chemical, absorption, adsorption and catalytic processes in column apparatuses, where the velocity distributions and interphase boundaries are unknown. The use of the physical approximations of the mechanics of continua for the interphase mass transfer process modeling in industrial column apparatuses is possible if the mass appearance (disappearance) of the reagents on the interphase surfaces of the elementary physical volumes (as a result of the heterogeneous reactions) are replaced by the mass appearance (disappearance) of the reagents in the same elementary physical volumes (as a result of the equivalent homogenous reactions), i.e. the surface mass sources (sinks), caused by absorption, adsorption or catalytic reactions must be replaced with equivalent volume mass sources (sinks). The solution of this problem is related with the creation of new type of convection-diffusion and average-concentration models (Chr. Boyadjiev, M. Doichinova, B. Boyadjiev, P. Popova-Krumova, Modeling of Column Apparatus Processes (Second Edition), Springer-Verlag, Berlin Heidelberg, 2018). The convection-diffusion models permit the qualitative analysis of the processes only, because the velocity distribution in the column is unknown. On this base is possible to be obtained the role of the different physical effect in the process and to reject those processes, whose relative influence is less than 1%, i.e. to be made process mechanism identification. The average-concentration models are obtained from the convection-diffusion models, where average velocities and concentrations are introduced. The velocity distributions are introduced by the parameters in the model, which must to be determined experimentally.

Recent Publications:

1. Chr. Boyadjiev, Theoretical Chemical Engineering. Modeling and simulation, Springer-Verlag, Berlin Heidelberg, 2010.
2. Chr. Boyadjiev, M. Doichinova, B. Boyadjiev, P. Popova-Krumova, Modeling of Column Apparatus Processes, Springer-Verlag, Berlin Heidelberg, 2016.
3. B. Boyadjiev, Chr. Boyadjiev, New Models of Industrial Column Chemical Reactors, Bulgarian Chemical Communications, 49(3), 706-710, 2017.
4. B. Boyadjiev, Chr. Boyadjiev, New Models of Industrial Column Absorbers. 1. Co-current absorption processes, Bulgarian Chemical Communications, 49(3), 711-719, 2017.
5. Boyadjiev, Chr. Boyadjiev, New Models of Industrial Column Absorbers. 2. Counter-current absorption processes, Bulgarian Chemical Communications, 49(3), 720-728, 2017.
6. B. Boyadjiev, Chr. Boyadjiev, New Models of Industrial Column Adsorbers, J. Eng. Thermophysics, 27(1), 1-16, 2018.
7. Chr. Boyadjiev, M. Doichinova, B. Boyadjiev, P. Popova-Krumova, Modeling of Column Apparatus Processes (Second Edition), Springer-Verlag, Berlin Heidelberg, 2018.

Biography

Christo Boyadjiev has done PhD (1968) in USSR, Moscow Institute of Chemical Mechanical Engineering. Doctor of Technical Sciences of Higher Institute of Chemical Technology (Sofia, Bulgaria). Associate Professor in 1971. Professor in Chemical Engineering, since 1981. Editor-in-Chief of the "Transactions of Academenergo" (Scientific journal of the Russian Academy of Science). Chairman of the Scientific Council of the International Scientific Centre for Power and Chemical Engineering Problems Chairman of the Organizing Committee of the Workshop on "Transport Phenomena in Two-Phase Flows" (No.1 - 15). Specializations: 1963, USSR, Moscow, Supervisor-Prof. V.G. Levich, 4 months; 1968, USSR, Novosibirsk, Supervisor-Prof. M.G. Slinko, 4 month.

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