41d Extensive Utilization of the Linear Least Squares Method for the Unit Operations Laboratory Class

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There are eight experiments such as distillation I & II, reaction, filtration, packed/fluidized beds, and hydrodynamics/CO_2 absorption offered for the senior unit operations class. Most experiments need the linear least-squares method to interpret experimental data and extract desired relationships between operation variables, parameters, and constants from raw experimental data.

A reaction rate constant and a reaction order are evaluated by applying a series of reaction experimental data of concentrations of reactants at various reaction durations to a reactor design equation with the aid of the linear least squares method. A filter medium resistance and a specific cake resistance are evaluated by applying a series of filtration experimental data of filtration volumes at various filtration durations to a filtration equation with the aid of the linear least squares method.

A relationship between friction factors and particle Reynolds numbers is evaluated by applying a series of packed-beds experimental data of pressure drops at various volumetric flow rates to a pressure drop equation of a packed bed with the aid of the linear least squares method. A relationship between pressure drops and volumetric flow rates is evaluated by applying a series of hydrodynamics experimental data of pressure drops at various volumetric flow rates to the linear least squares method.

The objectives of applying the linear least-squares method to raw experimental data or dependent variables obtained from raw experimental data are for our students to be familiar with statistical analysis of experimental data, to understand accuracies of experimental data with correlation coefficients obtained from statistical analysis of experimental data, to be able to recognize and omit some bad experimental data deviated noticeably from the rest of experimental data set, and to identify possible experimental error sources.