Dynamic modeling of a fixed-bed reactor with finite element method

임유경[1], 한규상[1,2], 이종민[1,3], 윤인섭[1,2,*]
[1]서울대학교; [2]서울대학교 공정시스템 및 안전 연구실;
[3]서울대학교 에너지공정공학연구실
(esyoon@pslab.snu.ac.kr*)

The purpose of this study is to produce a stable simulation of a fixed-bed reactor using an imaginary input stream with assumed molar concentration, temperature and flow rate. Galerkin method is applied as the numerical integration mechanism. Several assumptions are adopted to make the process simulation as simple as possible. The fixed-bed reactor shape is shell-and-tube type. Catalysts are pulverized into fine grains and reactions are expected to take place on the surface of catalysts. To simplify the mass balance, total mass flow rate is held constant and only component mass balances are considered in modeling. Dochain(1992) studied fixed-bed reactors for biological reactions and made assumption that diffusion term is negligible. Lordanidis (2002) suggested that convection is usually more dominant than diffusion if the material flowrate is suffciently fast enough. Therefore the diffusion term is dropped out from the material balance and is turned into a hyperbolic wave equation. Also the reactor is assumed to be isothermal and to have homogeneous gas-phase.