C. Pătruț, *Modeling, design and control of (catalytic) cyclic distillation columns*, University Politehnica of Bucharest, 2019

The main contributions of this thesis in the field of cyclic operation of (catalytic) distillation columns are the following: (1) Development of a mathematical model which uses dynamic balance equations together with non-linear equilibrium. Compared to mathematical models which were developed before, this model can be applied for columns with more than a few ideal stages, for mixtures which require the use of a complicated thermodynamic models and it can be easily extended for systems with chemical reaction. (2) Development of an algorithm for sizing the cyclic distillation columns for the general case of multi-component mixtures and nonlinear equilibrium. The method is equivalent with following the liquid as it moves back in time from the reboiler to the condenser and calculating the number of stages knowing the total time and the duration of the vapour-flow period. (3) Extension of cyclic distillation and sizing algorithm to catalytic systems. It was observed that the advantages of cyclic operation compared to conventional operation have been preserved: higher purity, higher flexibility and lower energy consumption. (4) Investigation of the state multiplicity and stability in catalytic cyclic distillation. When studying the dependence of the periodic state on the reflux amount at constant vapour flowrate, it was observed that a stable and an unstable branch exist for the same values of the model parameters. (5) Use of cyclic distillation to separate a highly non-ideal mixture and investigation of the economic aspect of cyclic distillation. The study confirms that for the separation of water-acetic acid mixture, cyclic distillation is more efficient than conventional distillation, but azeotropic distillation proved to be more convenient from an economic point of view.