Abstract

Optimal Grade Transition of a Non-Isothermal Continuous Reactor with Multi-Objective Dynamic Optimization Approach

Sandesh Yashwant Shirude

MTech (16210085)

2018

Thesis Supervisor

Dr. Nitin U. Padhiyar
Chemical Engineering Discipline

Dynamic Optimization (DO) is a useful tool for carrying out grade transitions in polymer industry. Most open literature on DO emphasizes such grade transitions using single objective optimization. However, often there are multiple criteria which must be satisfied simultaneously for economic benefits. In this work, we solve a multi-objective DO problem for free-radical polymerization of methyl methacrylate in non-isothermal continuous stirred tank reactor. The process objectives considered in the DO activity include minimization of off-spec, minimization of grade transition time, and minimization of the feed flowrates (manipulated variables). The manipulated variables considered for this problem are the initiator and coolant flowrates. The DO problem is solved using control vector parameterization (CVP) approach with first order interpolation trial function. The solution of the aforementioned multi objective DO problem is obtained in terms of a trade-off curve, pareto curve, using a non-dominated sorting genetic algorithm (NSGA II). The three-dimensional pareto front is then projected to each of the three pairs of the objectives for better visualization and analysis. Furthermore,

three representative pareto solution points, namely the two end points and a utopia point are further analysed for of each of the two objective pareto solution curves.