Economic model predictive control (EMPC) of a fluid catalytic cracking unit (FCCU)

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Recently, economic model predictive control (eMPC) has been suggested as an alternative to the current hierarchical decomposition by taking a general economic cost function in its formulation. However, its real application to the fluid catalytic cracking unit (FCCU) is challenging because of the existence of strong interactions and nonlinearities within the unit. Therefore, in this study, we adopt the simultaneous collocation method to deal with both the dynamic optimization problem and the control problem for maximizing the amount of LPG under some uncertainties (e.g., feed composition and feed temperature changes). This method follows a full discretization strategy, especially Runge-Kutta basis representation for the differential states, to avoid intermediate solutions in the sequential method and to guarantee more robust results. Additionally, to obtain the control action within a reasonable CPU time, CONOPT - one of powerful NLP solvers using the generalized reduced gradient algorithm - is used to deal with more than 1000 differential and algebraic equations (DAEs) in the dynamic modeling developed in our laboratory.