Steady-State Real-Time Optimization using Transient Measurements

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Abstract

Real-time optimization (RTO) is an established technology, where the process economics are optimized using rigorous steady-state models. However, a fundamental limiting factor of current static RTO implementation is the steady-state wait time. We propose a “hybrid” approach where the model adaptation is done using dynamic models and transient measurements and the optimization is performed using static models. Using an oil production network optimization as case study, we show that the Hybrid RTO can provide similar performance to dynamic optimization in terms of convergence rate to the optimal point, at computation times similar to static RTO. The paper also provides some discussions on static versus dynamic optimization problem formulations.

Keywords: Real-Time Optimization, steady-state optimization, dynamic models, production optimization, hybrid RTO

1. Introduction

Industrial processes usually consist of many operations and various components that have their own objectives and complex interconnections with other components. The safe and optimal operation of such large and complex processes requires meeting goals and objectives in different time scales ranging from planning and scheduling to fast corrective actions for regulatory control. Realizing all the goals and constraints as a whole can be a very challenging and unrealistic task. Thus the operation of any process is typically decomposed into various decision making layers [1, Ch.10], [2]. Such a hierarchical implementation is a widely accepted industry standard [3] and is also well studied in academic literature under the context of plantwide optimization by iteratively adjusting the decision variables using static models. However, a fundamental limiting factor of current static RTO implementation is the steady-state wait time. We propose a “hybrid” approach where the model adaptation is done using dynamic models and transient measurements and the optimization is performed using static models. The authors gratefully acknowledge the financial support from SUBPRO, which is financed by the Research Council of Norway, major industry partners and NTNU.

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