

SHORT-TERM SCHEDULING OF REFINERY OPERATIONS

by

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Dedicated
to
My Parents and My Wife

CERTIFICATE

I am satisfied that the thesis presented by **Mr Sanjeev Yadav** on “***Short-Term Scheduling of Refinery Operations***” is worthy of consideration for the award of the degree of Doctor of Philosophy and is a record of the original bonafide research work carried out under my guidance and supervision and that the results contained in it have not been submitted in part or full to any other university or institute for award of any degree/diploma.

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ABSTRACT

Scheduling refers to the optimal use of available resources for maximizing the productivity or profit of the plant. And there are several optimization models available in the scheduling literature. In this study we focus on short-term scheduling of continuous plants with applications in refinery operations using state-task-network (STN) process representation and unit-specific event based continuous-time representation. These two aspects have not been addressed adequately in the literature for refinery operations, where there are tremendous opportunities for optimization and improved resource utilization. A single model for the overall refinery from crude oil arrival to product distribution leads to intractable mathematical models. Hence, the overall problem of scheduling of refinery operations has been divided into three parts. The first part is optimal *crude-oil operations* involving unloading and loading of crude-oils. The second part deals with scheduling of refinery *production processes*, and the third part involves *product blending and distribution*.

Different possibilities for mixing and material flow in storage and charging tanks are explored in this work and accordingly new modeling constraints are proposed. Combination of issues such as whether bypassing is allowed or not, simultaneous input and output is allowed or not, and mixing is allowed or not are treated in a unified way. In all the proposed models the elegance of STN representation is demonstrated. Unit-specific event-based formulations are proposed for scheduling of crude-oil operations in inland and marine-access refineries resulting in better ways of handling material transfer from storage and charging tanks. For handling of discrete resources unit specific alignment is proposed resulting in lesser number of events. Issues related to continuous flow of feed streams, stream splitting and mixing, changeovers, operation of continuous and non-continuous units, minimum run lengths, multi-purpose product tanks, and

multiple orders are effectively handled. The proposed models are demonstrated on several examples drawn from different parts of the refinery operations.

Keywords: Scheduling, Optimization, Crude-oil, Refinery Operations, Unit-Specific Events, Storage, State-task-networks.

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