Optimal Scheduling of Refined Products Pipelines and Terminal Operations

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OVERVIEW

We address the problem of scheduling a transmission pipeline carrying several petroleum products from a single oil refinery to a unique distribution center over a monthly horizon. The proposed MILP continuous-time formulation is capable of determining the optimal lot sizes and the batch sequence into the pipeline, as well as the schedule of lot injections in the line and product deliveries to the distribution terminal. Moreover, the MILP model rigorously accounts for customer product demands on a daily basis, key terminal operations like lot settling periods for quality control tasks and a predefined set of alternative lot sizes to get a better usage of the tank capacity at the terminal. The approach neither requires to divide pipeline segments into a number of single-product packs of known capacities since the volume scale is also handled in a continuous manner. We solve 3 versions of the model for fixed sequence, mixed sequences and totally free sequencing on a real-world case study. In the first case, the sequence of products to be shipped through the pipeline is arbitrarily adopted before solving the problem formulation to just optimize the lot sizing process. The second case assumes that the pipeline scheduler has adopted an incomplete pre-defined product sequence with a limited number of open positions to be filled with pre-defined allowable products. In this case, the problem formulation is aimed at optimally assigning products to open positions and determining the size of every batch. In

the last case, the proposed formulation permits to establish both the complete sequence of products to be injected in the pipeline and the lot sizing. In any case, the proposed mathematical model has been solved using two MILP commercial solvers: GAMS/CPLEX 11.2.1, and GAMS/GUROBI 1.0.4.

Reference

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