MPEC strategies for optimization of pipeline operations

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Problem statement

A gas pipeline system consists of suppliers and customers connected through a pipeline network. These pipeline networks are common when industrial gas customers are located in close proximity. The efficient operation of such pipeline networks is not straightforward as the dynamic behavior of the system affects the operation, pricing, and inventory.

In the problem considered, arcs $i \in I$ in the network represent pipe segments. Nodes $j \in J$ are located at the intersections of pipe segments. A dynamic model of the pipeline system is developed that has the capability of handling flow reversals, flow transitions and other nonsmooth elements through an MPEC (Mathematical Programming with Equilibrium Constraints) approach. The model is defined over the set of discrete points in time, $t \in T$. Sets S and D are used to denote the supplies (flows into the network) and demands (flows out of the network). The objective of this problem is to minimize the power required by the compressor to deliver gas to demand nodes subject to supplier capacity, customer demand, and constraints representing the physics of the pipeline.

References

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