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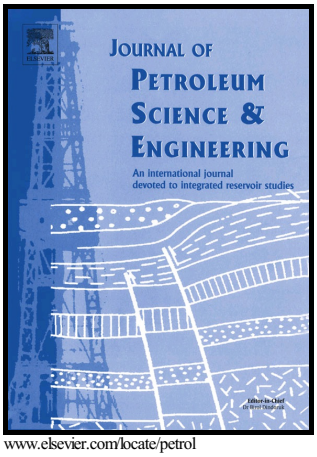

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Abstract:
Production well gathering pipeline network, usually characterized by various and complex structure and high investment, is one of significant parts of oil-gas field construction. Optimization of production well fluid-gathering system is critical to reducing development cost. A variety of previous research focused on the issue. However, those methods were less applicable for dealing with the challenges of compatibility to various structures, integral optimization and finding the optimum. This paper focuses on stellated pipeline network, cascade dendritic pipeline network and insertion dendritic pipeline network, three common connection structures of gathering pipeline, and establishes a versatile mixed-integer linear programming model with considering terrain and obstacle conditions. Minimizing the total investment is the object of this model. Constraints of central processing facility, manifolds, flow rate, pipeline construction and connection mode are taken into consideration in the model. The optimal topological structure, position of central processing facility, diameter and route of each pipeline are obtained integrally by solving this model with GUROBI solver. Finally, two virtual oil-gas fields and a real-world gas field are taken as examples to verify the reliability and practicality of the model.

Keywords:
Oil-gas gathering pipeline network; Topological structure; integral optimization; Mixed-integer linear programming

Nomenclature

Abbreviations

CDPN	Cascade dendritic pipeline network.
CPF	Central processing facility.
CNY	Chinese Yuan.
IDPN	Insertion dendritic pipeline network.
MILP	Mixed-integer linear programming.
NPC	Non-deterministic polynomial complete.
PWGPN	Production well gathering pipeline network.
SPN	Stellated pipeline network.

Sets and indices

$a \in A$	Set of numbering of flow rate division
$(i, j),(i', j'),(i'', j''),\left(ri_{i,j,k}, rj_{i,j,k}\right) \in I$	Set of coordinate of node in the studied area
$k, rk_k \in K$	Set of direction of connecting nodes. rk_k is the opposite