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Optimal design and operation of gas processing plant (GPP) under uncertain upstream conditions

Uncertainty is an inherent characteristic of any process. It may arise both from external and internal factors and has a profound effect especially for gas processing plant as its feeds are normally originated from upstream production facilities. Thus, the plant is usually subjected to continuous variations in upstream conditions, such as feed flow rate, composition, ambient temperature and pipeline pressure. These variations effects propagate throughout the plant and affect its normal operation. As a result, decision making for optimal operating conditions of an in-operating plant is a complex problem and it is exacerbated with changing product specifications and utility requirements. Moreover, the condition of feed composition is an important factor since it mainly determines what kind of process configuration to be employed for recovering natural gas liquids (NGLs). Besides, due to the number of process schemes developed for NGL recovery, it is usually difficult to select the best process scheme that can consolidate capital and operating costs within an acceptable range. In industrial practice, heuristic optimization approach based on trial and error have been employed to solve those problems. The main reason for such kind of decision is due to lack of systematic solution approach. As a result, aggressive decision may be preferred due to high profit expectation. However, this strategy will deteriorate the objective function and later leads to constraint violation. Therefore, a systematic method is required to evaluate the trade-off between profitability and reliability of holding the process constraints. The challenge here is how to find solution approaches that can incorporate all these uncertainties effect and enable us to make prior-decision for the in-operating plant.
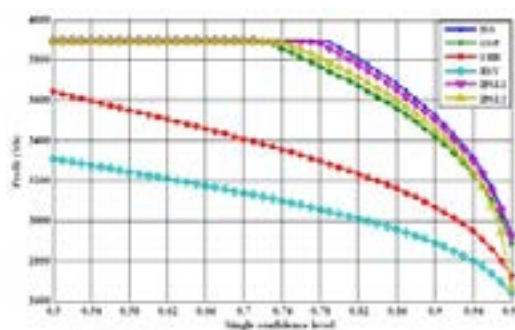

Fig. 8. Profit profile for the process scheme from single chance constrained optimization.

Biography

Mesfin G Woldetensay is currently working as Assistant Professor & Program Director of Chemical Engineering at Heriot-Watt University Dubai Campus. He was a Postdoc Fellow at Yeungnam Univeristy (South Korea) before joining Curtin University, Sarawak Malay as Faculty Staff. He has won the 2014 IChemE Malaysia Award for Research Innovation and Excellence. He also got a prize for his research being highly commended in the Petrochemical Processing Award in 2013 IChemE Malaysia Awards for Innovation and Excellence. He has won the 2015 APAC-EMEA (Asia Pacific, Europe, Middle East & Africa) Honeywell UniSim Design Challenge & the 2014 Asia Pacific Honeywell UniSim Design Challenge. His current research work focuses on optimal design and operation of thermally coupled distillation unit under uncertainties.

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