CATS CENTRE FOR THE ANALYSIS OF TIME SERIES

The Process Synthesis Tool:
Optimum decision steering in a complex process space-GTL

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Optimal synthesis of a GasToLiquid complex is complicated due to many degrees of freedom in a highly constrained design space. One can choose between alternative, competing syngas manufacturing technologies, different types of Fischer–Tropsch catalysts and reactors, with numerous connectivity options and a range of operational conditions. On the other hand, the design space is confined by equipment, operational and knowledge constraints. Furthermore, economic performance needs to be aligned with carbon and energy efficiencies. To support GTL process design a computational synthesis tool is under development. Its purpose is to find and analyse the optimum structure and operational conditions for a given market scenario. The process model covers alternative syngas generation units and Fischer–Tropsch reactors with an extensive syngas recycle structure. The process units interact with the utility system, where power can be generated from offgas and/or excess steam. The units are modeled in a reduced, input–output way by algebraic equations, reflecting mass and energy balances and pressure effects. A superstructure arises when considering multiple stages for Fischer–Tropsch synthesis with parallel reactors. The synthesis tool, implemented in AIMMS®, is applied to a realistic sample problem, showing profit optimisation by varying the distribution of NG to syngas generation units with different efficiencies. A sensitivity analysis is carried out by means of Singular Value Decomposition of sensitivity matrices to find dominant patterns of parametric influence on the optimum.

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