H_2Plant

Steam Methane Reformer Simulation

H_2Plant is a steady state model of the Steam Methane Reforming process. The model is based on equilibrium and non-equilibrium reactions. It calculates important plant variables such as hydrogen purity & production, furnace duty, and operating cost. The model is meant for economic studies and to generate Planning LP vectors.

Model Description

The model is a flowsheet consisting of a feed drum, hydrogen furnace, shift converter, Methanator and CO_2 absorbtion section. Feed to the system can be any mixture of hydrogen and hydrocarbons ranging from methane to butane.

Important plant independent operating variables include feed rate, composition, furnace outlet temperature, steam/carbon ratio, shift converter inlet temperature & Methanator inlet temperature.

The model includes equilibrium relationships for all important reactions and calculates all intermediate stream compositions, flows, temperatures and enthalpies. The results summary includes equipment operation, for example heater duty and efficiency, shift converter temperature rise and Methanator temperature rise. Results also include selected product information such as hydrogen purity and flow, along with the utilities requirements and costs per unit of hydrogen produced.

Implementation

H_2Plant is currently implemented in Excel for ease of use. User interaction is confined to a single set worksheet showing the model variables which can be specified. The user also can set convergence speed and criteria. Previous good solutions are saved for model initialization.

Table 1- Example results

Steam / Carbon	H2 product (MMSCFD)	H2 purity (%)	Furnace Duty (MMBTU/h)	H2 Cost ($/MSCF)
3.0	112	93.3	535	4.61
4.0	126	96.4	698	4.28
5.0	132	97.8	863	4.22
6.0	136	98.4	1029	4.26
7.0	138	98.8	1196	4.33

Uses

H_2Plant can be used to find the best set of operating conditions in order to minimize hydrogen production cost. The technology can also be used to generate linearized models for use in LPs for optimization of large hydrogen complexes.

Figure 1- Use to calculate optimal operation

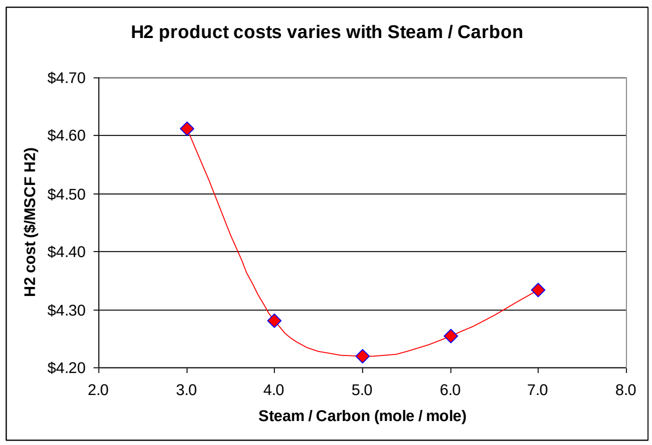
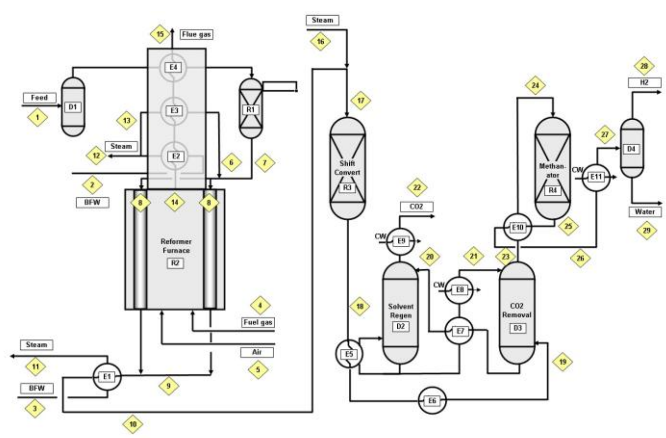


Figure 2- Model flowsheet



Advanced Industrial Modeling, Inc
1516 Sinaloa Drive
Santa Barbara, CA 93108
ph: 805.969.4449
fax: 805.695.0762
www.aimod.com