Ratio control: Ammonia synthesis reactor

Lecture notes for Advanced modeling and Control

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Example 15.1 from (Seborg et al. 2016)

A ratio control scheme is to be used to maintain a stoichiometric ratio of H_2 and N_2 as the feed to an ammonia synthesis reactor Figure 1. Individual flow controllers will be used for both the H_2 and N_2 streams. Using the information given below,

(a) Draw a schematic diagram for the ratio control scheme.
(b) Specify the appropriate gain for the ratio station, K_R.

Available information:

i. The electronic flow transmitters have built-in square root extractors. The spans of the flow transmitters are 30 L/min for H_2 and 15 L/min for N_2.

ii. The control valves have pneumatic actuators.

iii. Each required current-to-pressure (I/P) transducer has a gain of 0.75 psi/mA.

iv. The ratio station is an electronic instrument with 4–20 mA input and output signals.

References

Seborg, Dale E., Thomas F. Edgar, Duncan A. Mellichamp, and Francis J. Doyle III. 2016. *Process Dynamics and Control*. John Wiley & Sons. https://books.google.com?id=ZZVFEAAAQBAJ.
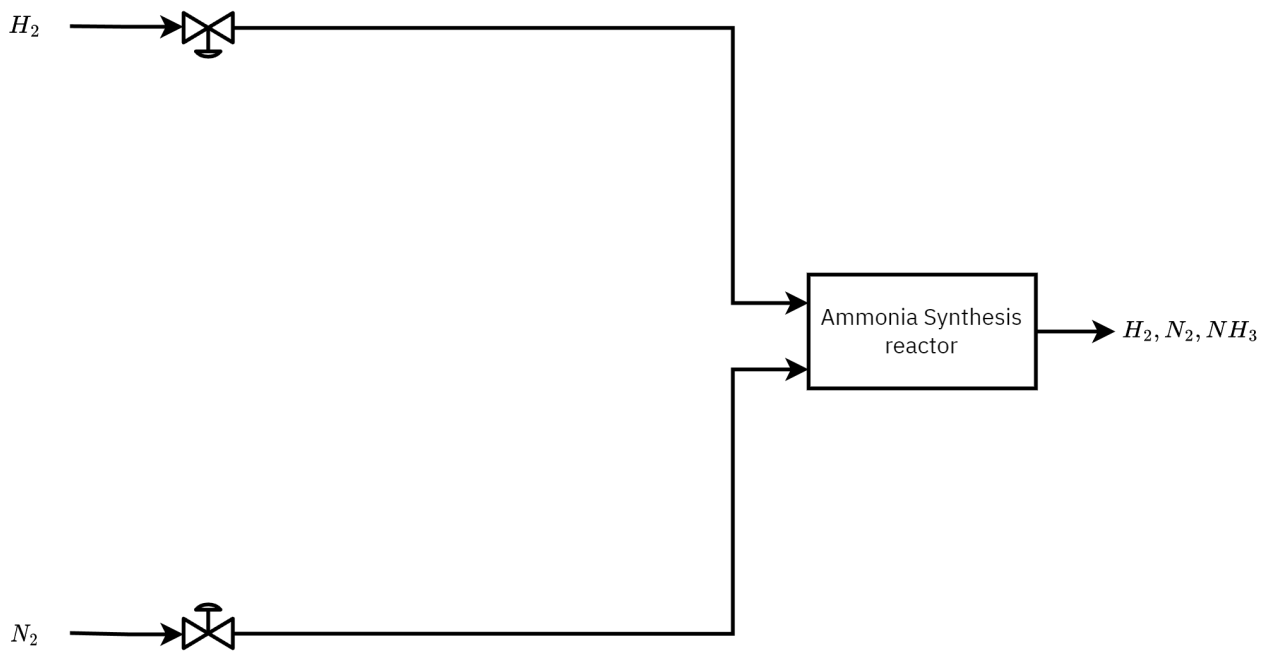
Figure 1: Ammonia synthesis reactor