Block Diagram Reductions

Block Diagram reduction

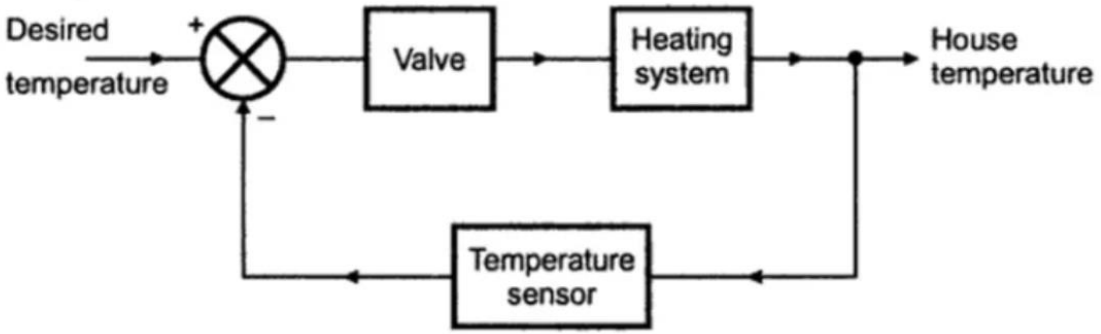
- We often represent control systems using block diagrams. A block diagram consists of blocks that

  represent transfer functions of the different variables of interest.
- If a block diagram has many blocks, not all of which are in cascade, then it is useful to have rules for rearranging the diagram such that you end up with only one block.

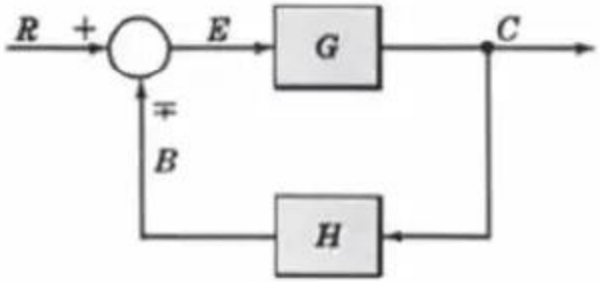
Examples of an closed loop system

Home Heating System

- In this system, the heating system is operated by a valve.
- The actual temperature is sensed by a thermal sensor and compared with the desired temperature.
- The difference between the two, actuates the valve mechanism to change the temperature as per the requirement.



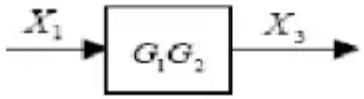
Block Diagram of Control System



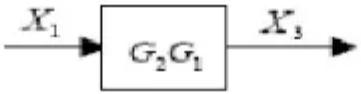
- R= reference ınput
- C=output
- E=actuating signal or Error
- H= feedback transfer function
- G= direct transfer function or forward transfer function
- H= feedback transfer function
- GH= loop transfer function or open loop transfer function
- C/R= G/1+GH

Block Diagram Transformations

1. Combining blocks in cascade

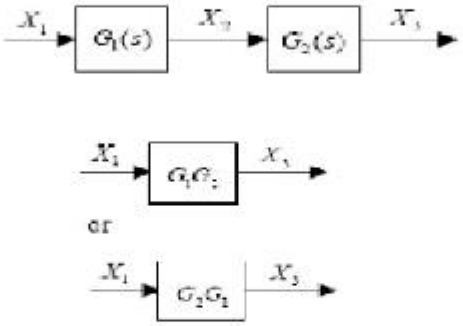


or



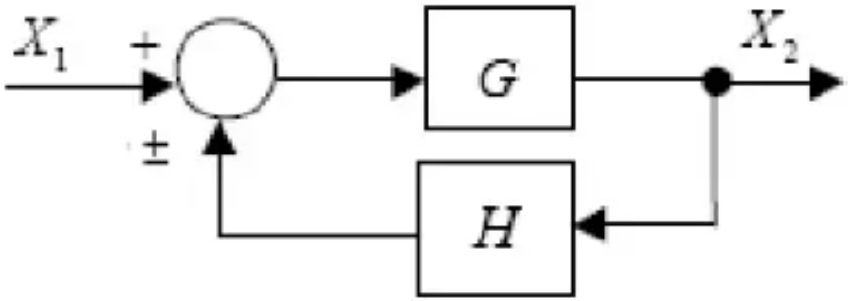
2. combining blocks in parallel

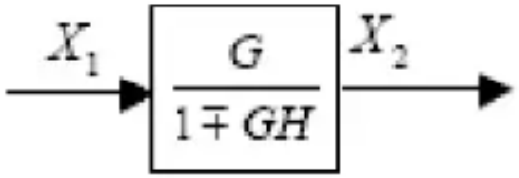
1. Combining blocks in cascade



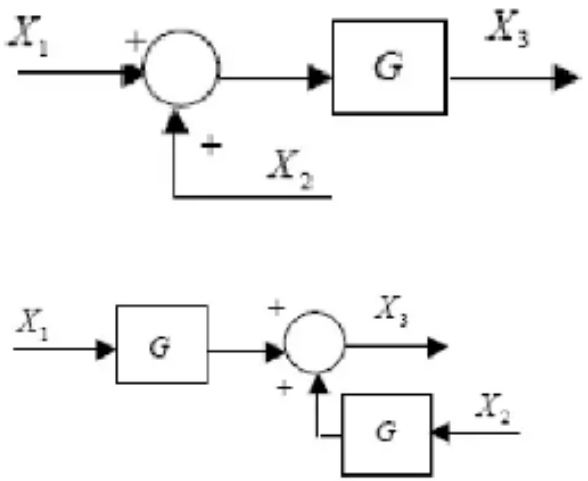
2. combining blocks in parallel

3. Eliminating a feedback loop

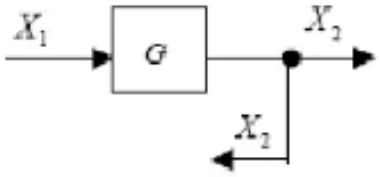


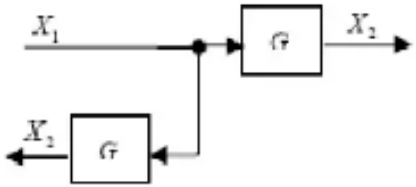


4. Moving a summing point behind a block

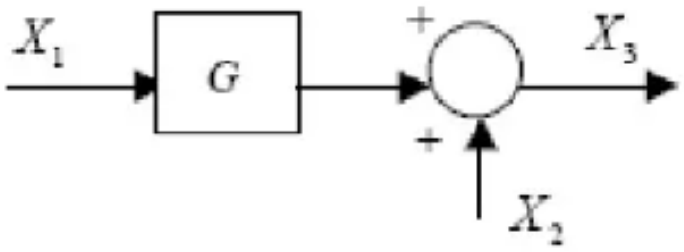


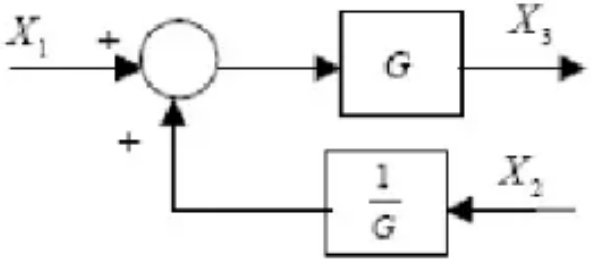
5. Moving a pickoff point ahead of a block





7. Moving a summing point ahead of a block





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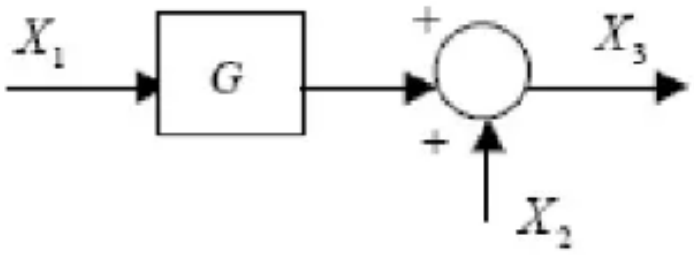
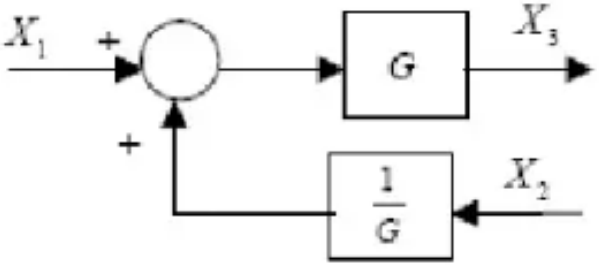
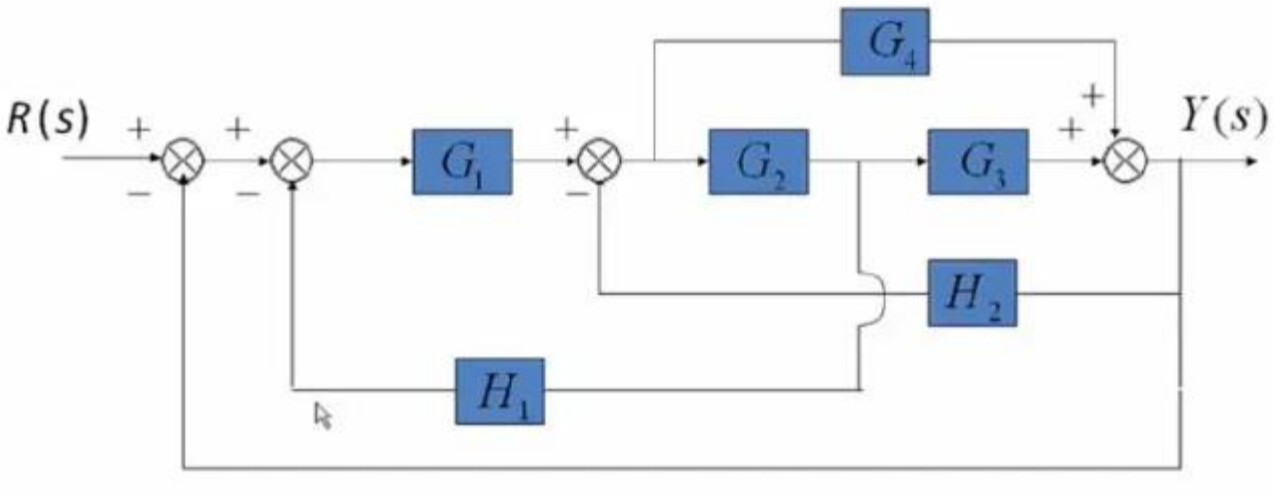


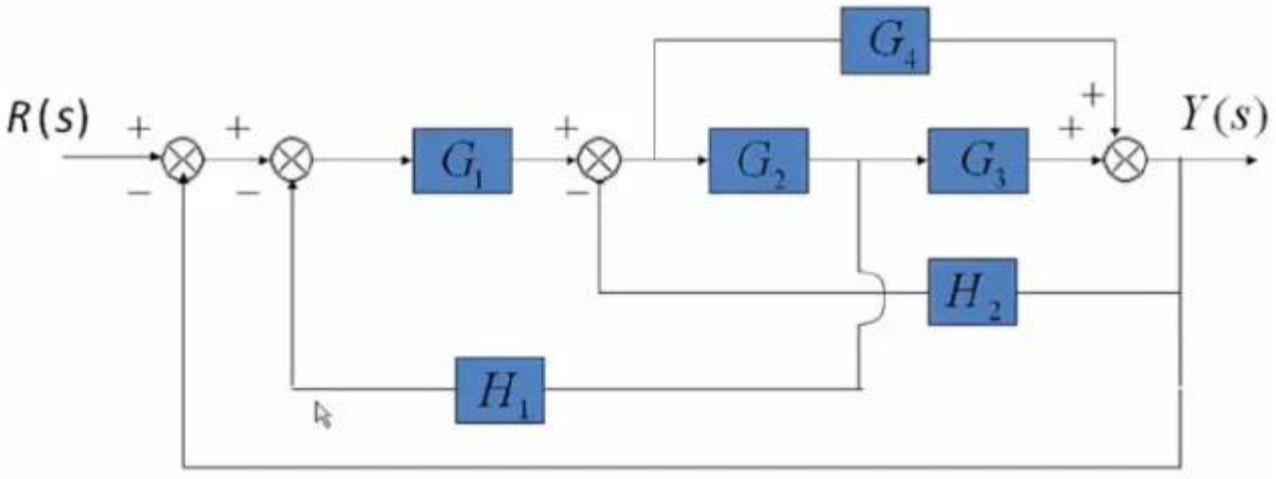


Example



Find the transfer of following diagram

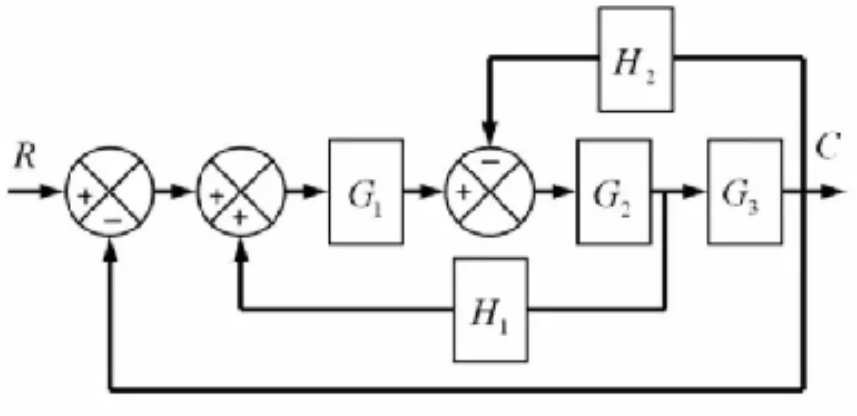
Example



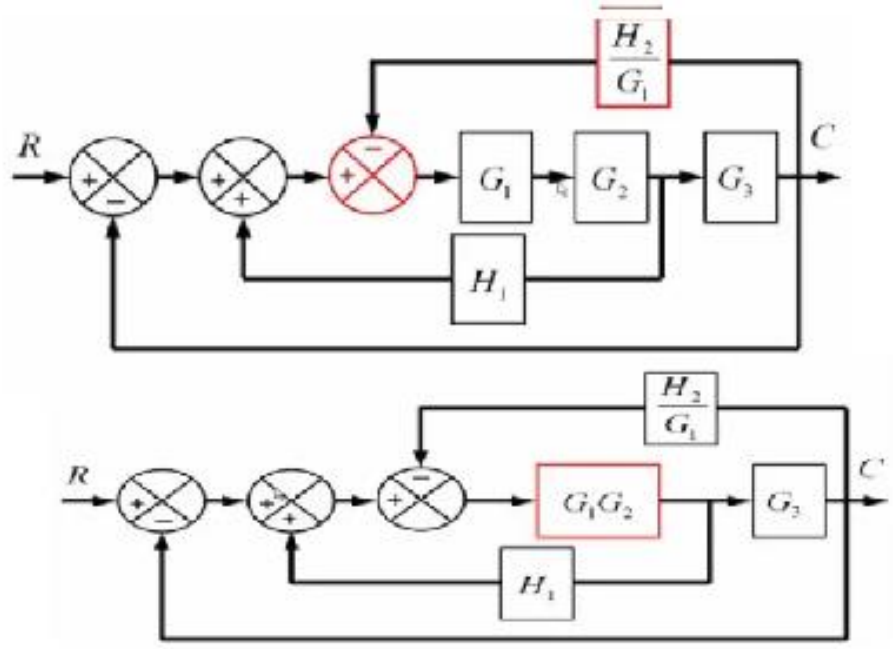
Find the transfer of following diagram

Example

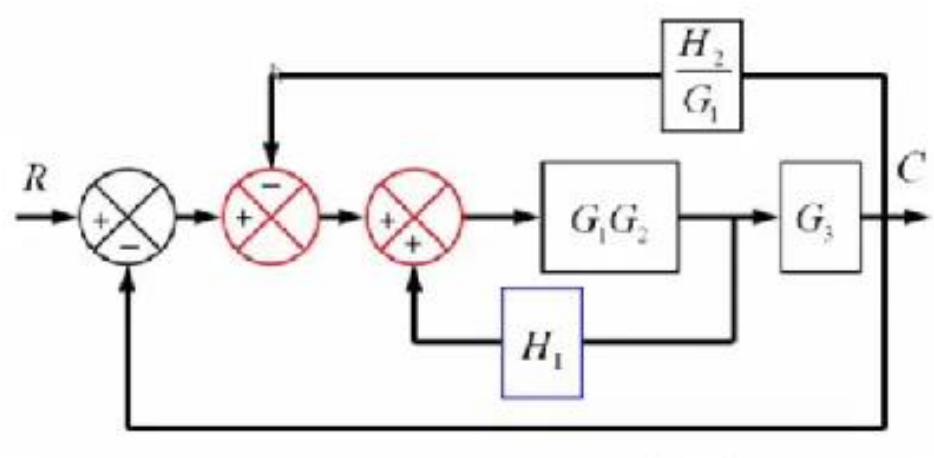
Reduce the following diagram to canonical form.

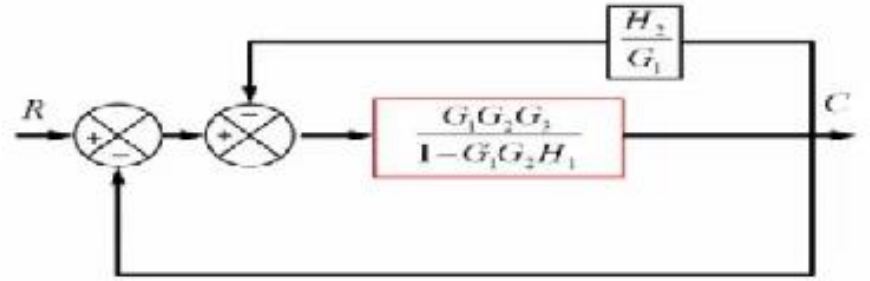


Example 3

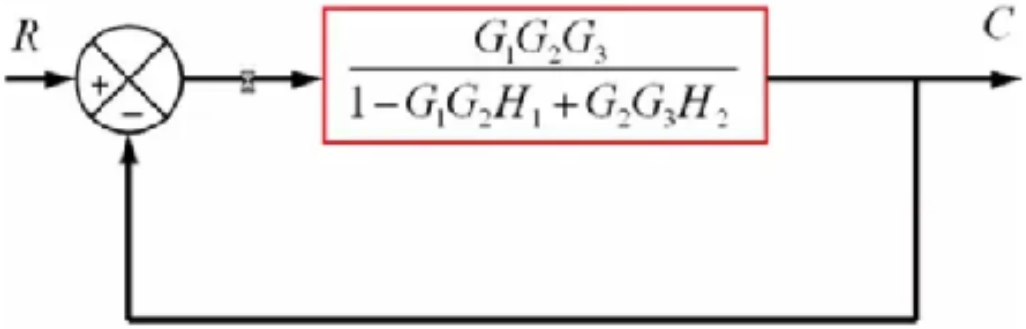


Example





Example :



Thank You