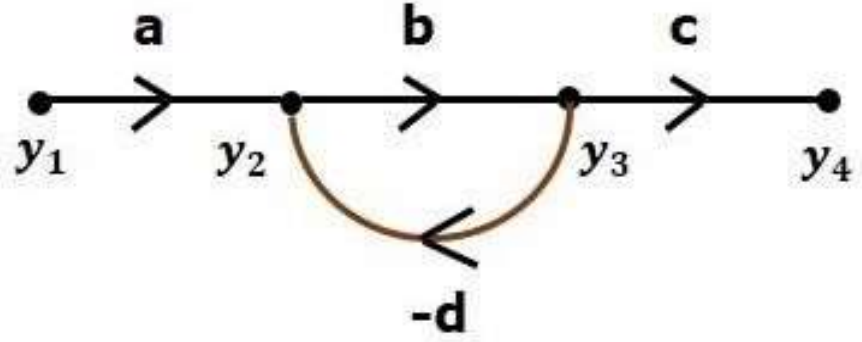
UNIT I

SIGNAL FLOW GRAPH

INTRODUCTION

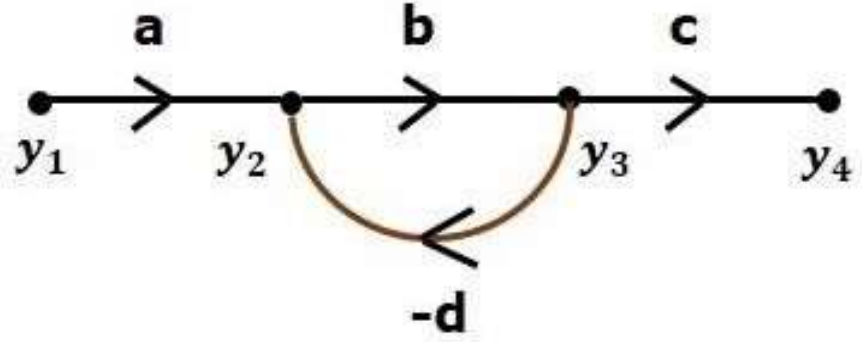
- Signal flow graph is a graphical representation of algebraic equations
- The block diagram reduction process takes more time for complicated system
- So, to overcome this drawback, use signal flow graphs (representation) is done where the calculation of transfer function is just by using a Mason's gain formula without doing any reduction process.

Basic Elements of Signal Flow Graph



- **Input Node** − It is a node, which has only outgoing branches.
- **Output Node** − It is a node, which has only incoming branches.
- **Branch** is a line segment which joins two nodes. It has both **gain** and **direction**
- **Open path**: A open path starts at a node and ends at another node

Basic Elements of Signal Flow Graph



- **Forward path**: It is a path from an input node to an output node that does not cross any node more than once.
- **Individual loop**: It is a closed path starting from one node and after passing through the graph arrives at the same node without crossing any node more than once.
- **Non-touching loops**: If a loop does not have a common node then they are said to be non-touching loops

Mason's Gain Formula

MASON'S GAIN FORMULA:-

Mason's gain formula states that,

Overall gain, $$T = \frac{1}{\Delta} \sum_{k} P_k \Delta_k .$$

where, $T = T(s)$ = Transfer fn of the system.

P_k = Forward path gain of k^{th} forward path.

$\Delta = 1 - (\text{Sum of individual loop gains})$
$+ [\text{Sum of gain products of all possible combinations of two non-touching loops}]$
$- [\text{Sum of gain products of all possible combinations of three non-touching loops}]$
$+ - - - - -$

Δ_k = Δ for that part of the graph which is not touching k^{th} forward paths.

Conversion of Block Diagrams into Signal Flow Graphs

- Represent all the signals, variables, summing points and take-off points of block diagram as **nodes** in signal flow graph.
- Represent the blocks of block diagram as **branches** in signal flow graph.
- Represent the transfer functions inside the blocks of block diagram as **gains** of the branches in signal flow graph.
- Connect the nodes as per the block diagram.