**Lecture#9 Signal Flow Graphs**

**Definitions:** Before we discuss signal flow graphs, we must define certain terms.

***Node*:** *A* node is a point representing a variable or signal.

***Transnzittance:***The transmittance is a real gain or complex gain between two nodes.

***Branch*:**A branch is a directed line segment joining two nodes.

***Input node* (*source*):**An input node or source is a node that has only outgoing branches (independent variable).

***Output node (sink*):**An output node or sink is a node that has only incoming branches (dependent variable).

***Mixed node*:** *A* mixed node is a node that has both incoming and outgoing branches.

***Loop*:** *A* loop is a closed path.

***Loop gain*:**The loop gain is the product of the branch transmittances of a loop.

***Nontouching loops*:**Loops are nontouching if they do not possess any common nodes.

***Forward path*:** *A* forward path is a path from an input node (source) to an output node (sink) that does not cross any nodes more than once.

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**\*representing block diagram by signal flow graphs**



ملاحظة:1- اذا جاءت ال take off point بعد الsumming مباشرا فتمثل هي والsumming بنود واحد فقط

 2- اذا جاءت ال take off point قبل الsumming فيمثلان بنودين يفصل بينهما واحد( (gain=1



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 **\* Mason's Gain Formula for Signal Flow Graphs:**



**Ex(1):** Consider the system shown in below, draw the signal flow graph (s.f.g) , then obbtain the closed-loop transfer function *C(s)/R(s)* by use of Mason's gain formula.





1-identify the forward paths : P1=G1G2G3

2-identify the loop: that there are three individual loops.

 L1= G1G2Hl

 L2 = -G2G3H2

 L3 = -G1G2G3

3- identify the touching & nontouching loops: all loop are touching loop

4-compute the determinant 

 

5-compute the cofactor  (note: No. of =No. of Pk ,  is determinant when Pk is removed) in this example Pk  is only one , so we have only 



Mason's formula

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Ex1: Consider the system shown in Figure below . Obtain the closed-loop transfer function *C(s)/R(s)* by use of Mason's gain formula.



Sol: 1-identify the forward paths :

