NETWORK ANALYSIS AND SYNTHESIS

Unit 1

Graph Theory

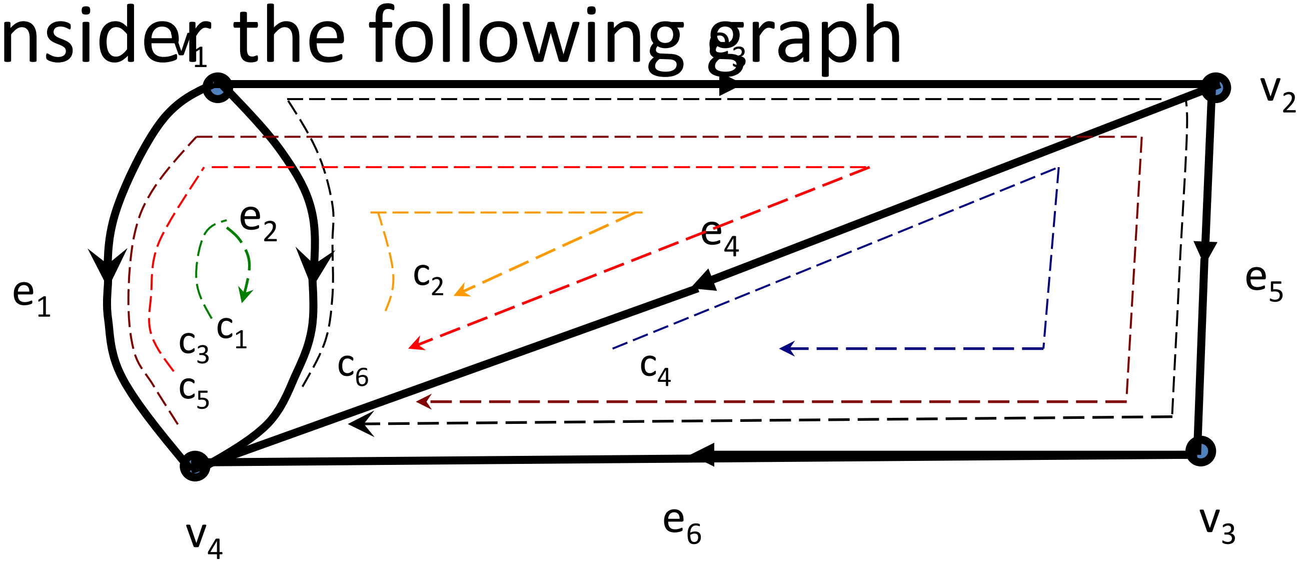
Matrices of Oriented Graphs

- In a graph G let k be the number of circuits and let an arbitrary circuit orientation be assigned to each one of these circuits.
- DEFINITION: The circuit matrix $\mathbf{B} = \left[b_{ij} \right]_{k,e}$ for a graph G of e edges and k circuits is defined as

$$b_{ij} = \begin{cases} 1 & \text{if edge } e_j \text{ is in the circuit } c_i \text{ and the orientations of } e_j \text{ and } c_i \text{ are coincident} \\ -1 & \text{if edge } e_j \text{ is in the circuit } c_i \text{ and the orientations of } e_j \text{ and } c_i \text{ are opposite} \\ 0 & \text{if edge } e_j \text{ is not in the circuit } c_i \end{cases}$$

Matrices of Oriented Graphs

- Consider the following graph



$$\mathbf{B} = \left[\begin{array}{cccccc|c} e_1 & e_2 & e_3 & e_4 & e_5 & e_6 & \\ \hline -1 & 1 & 0 & 0 & 0 & 0 & c_1 \\ 0 & -1 & 1 & 1 & 0 & 0 & c_2 \\ -1 & 0 & 1 & 1 & 0 & 0 & c_3 \\ 0 & 0 & 0 & -1 & 1 & 1 & c_4 \\ -1 & 0 & 1 & 0 & 1 & 1 & c_5 \\ 0 & -1 & 1 & 0 & 1 & 1 & c_6 \end{array}\right]$$

Matrices of Oriented Graphs

- Let $\mathbf{b}_i$ represent the row of **B** that corresponds to circuit c_i. The circuits $c_i,\ldots,c_j$ are independent if the rows $\mathbf{b}_i,\ldots\ \mathbf{b}_j$ are independent.
- DEFINITION: The f-circuit matrix $\mathbf{B_f}$ of a graph G with respect to some tree T is defined as the circuit matrix consisting of the fundamental circuits of G only whose orientations are chosen in the same direction as that of defining chords.

Matrices of Oriented Graphs

- The fundamental circuit matrix $\mathbf{B_f}$ of a graph G with respect to some tree T can always be written as

$$\mathbf{B_f} = \left[\overset{(\mathbf{r})}{\mathbf{B}} \quad \overset{(\mu)}{\mathbf{U}} \right] (\mu)$$

THANKS….

Queries Please…