Necessity of EHV-AC transmission, Advantages and Problems

- **Reduction of Electrical Losses, Increase in Transmission Efficiency, Improvement of Voltage Regulation and Reduction in Conductor Material Requirement**
- **Increase in Transmission Capacity of the Line**
- **Flexibility for Future System Growth**
- **Possibility of Interconnections of Power Systems**

- With increase in the transmission voltage size of the conductors is reduced (Cross section of the conductors reduce as current required to carry reduces.
- With the increase in the voltage of transmission, the insulation required between the conductors and the earthed tower increases. This increase the cost of line support.
- With increase in the voltage of transmission, more clearance is required between conductors and ground.

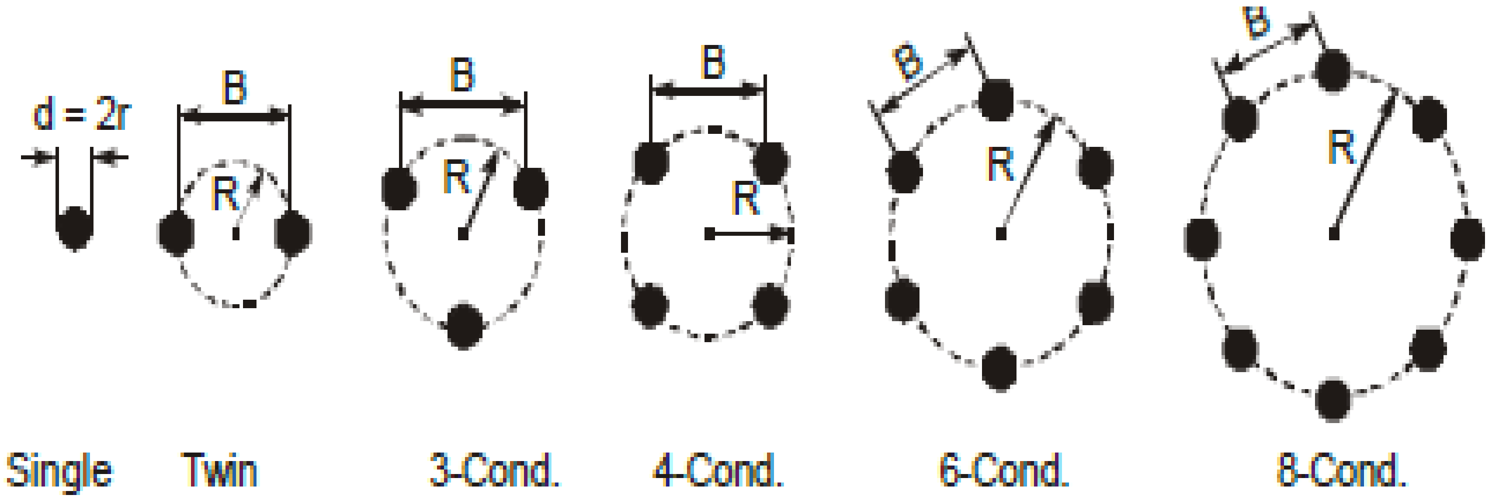
Power handling capacity and line losses

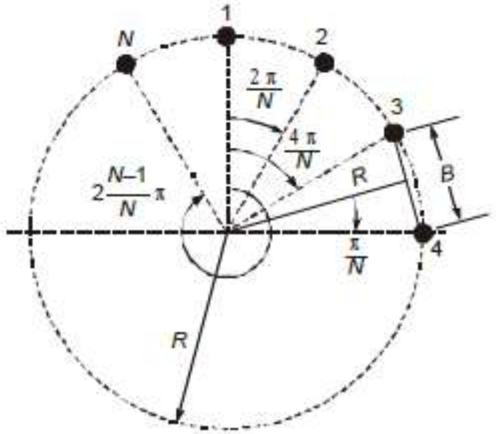
System kV	400	750	1000	1200
Percentage, Power Loss	$\frac{50}{10.55} = 4.76$	$\frac{50}{20} = 2.5$	$\frac{50}{64.2} = 0.78$	$\frac{50}{85.6} = 0.584$
Line Length, km	$P = 0.5E^2/Lx, MW$			
400	670	2860	6000	8625
600	450	1900	4000	5750
800	335	1430	3000	4310
1000	270	1140	2400	3450
1200	225	950	2000	2875

Mechanical considerations-resistance of conductors

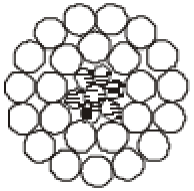
- **Aeolian Vibration**
- F=20065(v/d) Hz
- **Galloping**
- **Wake-Induced Oscillation**
- **Dampers and Spacers**

Properties of bundled conductors, bundle spacing and bundle radius




1
2
3
4
N
2 π / N
4 π / N
2 (N–1) / N π
R
B
R
π / N

Resistance of Conductors



Line inductance

- **Inductance of Two Conductors**

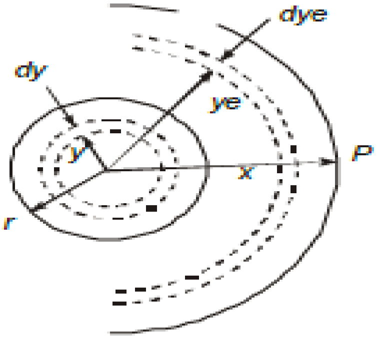


Fig. 3.6 Round conductor with internal and external flux linkages.

Effect of Resistance of Conductor

- **Power loss in transmission caused bv *I*2*R* heating.**
- **Power Lo**

Table 3.1. I^2R Loss in MW of E.H.V. Lines

System kV	400	750	1000	1200
Resistance, ohm/km	0.031	0.0136	0.0036	0.0027
Power Transmitted		*I^2R Loss, MW*		
1,000 MW	48	25	7.8	5.84
2,000	96	50	15.6	11.68
5,000	240	125	39	29.2
10,000	480	250	78	58.4
20,000	960	500	156	116.8

- **Skin Effect Resistance in Round Conductors**

Table 3.1. I^2R Loss in MW of E.H.V. Lines

System kV	400	750	1000	1200
Resistance, ohm/km	0.031	0.0136	0.0036	0.0027
Power Transmitted		*I^2R Loss, MW*		
1,000 MW	48	25	7.8	5.84
2,000	96	50	15.6	11.68
5,000	240	125	39	29.2
10,000	480	250	78	58.4
20,000	960	500	156	116.8

Sequence inductances and capacitances

- ***Inductance Due to Internal Flux***
- ***Inductance Due to External Flux***
- **Inductance of Multi-Conductor Lines—Maxwell's Coefficients**

Different modes of propagation,

- **Diagonalization Procedure**
- The resolution of mutually-interacting components of voltage, current, charge, or energy in
- waves propagating on the multi-conductors depends upon diagonalization of the $n \times n$ impedance matrix. A general procedure is given here while their application to Radio Noise, Switching
- Surges, etc, will be discussed in later chapters when we consider these problems individually.
- First consider the diagonalization of the inductance matrix of a transposed line
-

Ground return and their examples

- (*a*) Flow of current during short circuits involving ground. These are confined to single
- line to ground and double line to ground faults. During three phase to ground faults
- the system is still balanced;
- (*b*) Switching operations and lightning phenomena;
- (*c*) Propagation of waves on conductors;
- (*d*) Radio Noise studies