NETWORK THEORY

LECTURE 5

SECTION-D :NETWORK SYNTHESIS

SYNTHESIS OF L-C DRIVING POINT IMMITTANCES

- L-C immittance is a positive real function with poles and zeros on the jw axis only.

$$Z(s) = \frac{K_0}{s} + \frac{2K_2 s}{s^2 + \omega_2^2} + \frac{2K_4 s}{s^2 + \omega_4^2} + \ldots + K_\infty s$$

- The synthesis is accomplished directly from the partial fraction .
- F(s) is impedance -> then the term : K_0 / s capacitor of 1/K farads

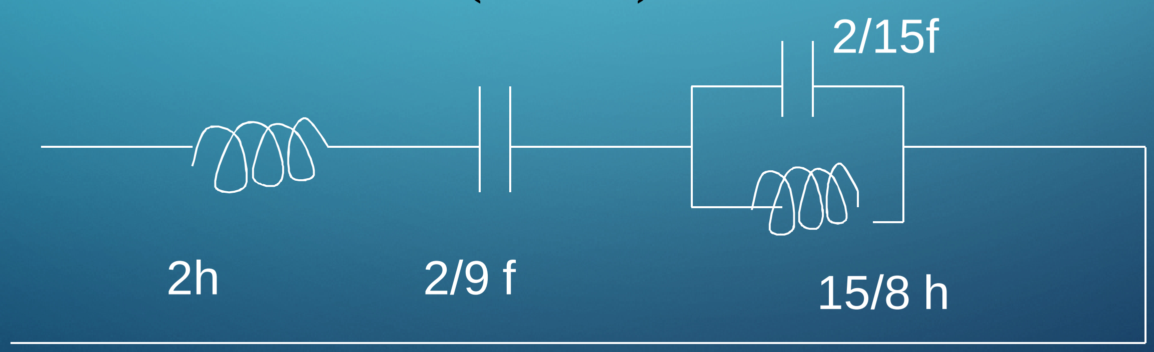
the K(infinite)s is an inductance of K(infinite) henrys.

OR Z(S) PARTIAL FRACTION

$2K_i s/(s^2+\omega_i^2)$ Is a parallel tank capacitance and inductance.

$1/2K_i$, $2K_i/\omega_i^2$

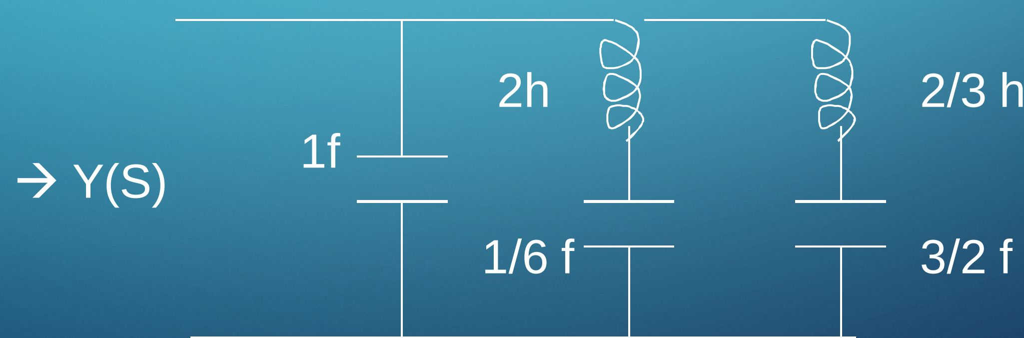
$$Z(s)=\frac{2(s^2+1)(s^2+9)}{s(s^2+4)}=2s+\frac{\frac{9}{2}}{s}+\frac{\frac{15}{2}s}{s^2+4}$$



OR Y(S) PARTIAL FRACTION

n admittance

$$Y(s) = \frac{s(s^2+2)(s^2+4)}{(s^2+1)(s^2+3)} = s + \frac{\frac{1}{2}s}{s^2+3} + \frac{\frac{3}{2}s}{s^2+1}$$



ANOTHER METHODOLOGY

- Using property 4 "The highest powers if numerator and denominator must differ by unity; the lowest powers also differ by unity."
  - Therefore, there is always a zero or a pole at s=infinite .
  - suppose Z(s) numerator:2n ,denominator:2n-1
  - this network has pole at infinite. -> we can remove this pole by removing an impedance $L_1 s$

$$Z_2(s) = Z(s) - L_1 s$$

- Degree of denominator : 2n-1 numerator:2n-2
  - $Z_2(s)$ has zero at s=infinite.
  - $Y_2(s) = 1/ Z_2(s)$, → $Y_3(s) = Y_2(s) - C_2 s$

- **This infinite term removing process continue until the remainder is zero.**

- **Each time we remove the pole, we remove an inductor or capacitor depending upon whether the function is an impedance or an admittance.**

- **→ Final synthesized is a ladder whose series arms are inductors and shunt arms are capacitors.**

$$Z(s)=\frac{2s^5+12s^3+16s}{s^4+4s^2+3}$$

$$Z_2(s)=\frac{2s^5+12s^3+16s}{s^4+4s^2+3}-2s=\frac{4s^3+10s}{s^4+4s^2+3}$$

$$Y_3(s)=\frac{s^4+4s^2+3}{4s^3+10s}-\frac{1}{4}s=\frac{\frac{3}{2}s^2+3}{4s^3+10s}$$

$$Z_4(s)=Z_3-\frac{8}{3}s=\frac{2s}{\frac{3}{2}s^2+3}$$

2h