- ***Techniques***:
  - ***Infinite-Value Time Constant (IVTC) Method***
    - ***Used for obtaining f_L***
  - ***Zero-Value Time Constant (ZVTC) Method***
    - ***Used for obtaining f_H***
- These techniques are ***extremely easy to apply***, and the results are ***quite close to actuals***
- However, there is ***one limitation*** of these techniques

- They give information only regarding the ***Dominant Pole*** (DP) of the circuit
- ***Completely hides information*** about ***other poles and zeros*** of the circuit [known as ***Non-Dominant Poles*** (NDP) or ***Zeros*** (NDZ)]
- Anyway, information about ***NDP and NDZ*** are ***not*** that ***critically important*** from ***practical point of view***

Low-Frequency Response

- ***The Infinite-Value Time Constant (IVTC) Technique***:
  - Used for obtaining the ***lower cutoff frequency*** (f_L)
  - If a circuit has ***n*** number of ***capacitors***, then it would have ***n*** number of ***time constants***
  - ***This technique derives the information regarding f_L from these time constants***

- ***The Algorithm***:
  - ***Null all independent sources to the circuit***
    - ***Short all independent voltage sources***
    - ***Open all independent current sources***
    - ***DO NOT TOUCH DEPENDENT SOURCES***
  - ***Name the capacitors C_i*** (***$i = 1\text{-}n$***)
  - ***Consider C_1 and assign infinite values to all other capacitors*** (***thus the name***!)
    - Thus, ***except C_1***, ***all other capacitors will short out***
  - ***Determine the Thevenin Resistance*** $\left(R_1^{\infty}\right)$ ***across the two terminals of C_1***

- ***Find the time constant τ_1 associated with C_1***

  $$\left(\tau_1 = R_1^{\infty} C_1\right)$$

- ***Calculate the corresponding frequency $f_1 = 1/(2\pi\tau_1)$***
- ***Repeat for all other capacitors***, ***taking one at a time***, and ***find all the rest of the frequencies*** $(f_2, f_3, \ldots, f_n)$
- Then the ***Lower Cutoff Frequency*** f_L can be expressed as:

  $$f_L = \left[\sum_{i=1}^{n} f_i^2\right]^{1/2}$$

- In ***discrete circuits***, a ***major component of total cost*** is due to the ***cost of the capacitors*** (***directly proportional to the value***)
- Hence, an attempt is made to ***minimize*** the ***total capacitor requirement of the circuit***
- For this, the ***Dominant Pole*** (DP) technique is used
  - ***One of the frequencies among f_1-f_n is made dominant***
  - ***Others are made to lie at least 10 times away from it***

- For example, if ***f_d is chosen to be the DP***, then ***all other poles are assumed to be at $f_d/10$***

$$\Rightarrow f_L = \left[f_d^2 + \sum_{n-1} \left(\frac{f_d}{10} \right)^2 \right]^{1/2}$$

- C_d, which ***contributes*** f_d, is ***chosen*** to be that capacitor that ***sees*** the ***least Thevenin resistance*** across its terminals
- ***Reason is obvious***:
  - If ***any other capacitor*** were ***chosen*** to ***contribute*** f_d, then C_d would have been ***ten times higher***
- ***This choice is based on heuristics***