

Relative Hz difference of PSDS - LTD (i.e. $|f_{PSDS}(t) - f_{LTD}(t)| \times 60\text{Hz}$)
 $\Delta\omega = 1 - \omega$

$$\dot{\omega}_{sys} = \frac{1}{2H_{sys}} \left(\frac{P_{acc,sys}}{\omega_{sys}(t)} - D_{sys}\Delta\omega_{sys}(t) \right)$$

ACE Conventions: Positive ACE denotes over generation. B (the frequency bias) is negative.

$$\begin{aligned} \text{ACE}_{\text{tie line}} &= P_{gen} - P_{load} - P_{\text{sched interchange}} \\ \text{ACE}_{\text{frequency bias}} &= 10B(f_{\text{actual}} - f_{\text{sched}})f_{base} \\ \text{ACE} &= \text{ACE}_{\text{tie line}} - \text{ACE}_{\text{frequency bias}} \end{aligned}$$

One way to think of deviation plots is $\text{LTD}_{data} + \text{Deviation}_{data} = \text{PSDS}_{data}$.
 (Assuming all time step issues are handled appropriately.)

$$\%diff = \frac{|x - y|}{\frac{x+y}{2}} * 100\%$$

Distribution of accelerating power based on inertia:

$$P_{e,i}(t) = P_{e,i}(t-1) - \Delta P_{acc,sys}(t) \frac{H_i}{H_{sys}}$$

The theoretical steady state frequency was calculated as

$$f_{ss} = f_{ref} + \Delta f = f_{ref} + \frac{\Delta P}{S_{base}\beta} \quad (1)$$

When R is a Pu value, β for N governor equipped machines is calculated as

$$\beta = \sum_{i=1}^N \frac{1}{R_i \frac{S_{Base}}{M_{Base_i}}} \quad (2)$$

Additionally, in a system with N generators, the weighted system frequency, f_w , is calculated as

$$f_w \text{ Pu} = \sum_{i=1}^N \frac{f_i}{f_{Base}} \frac{H_i M_{Base_i}}{H_{sys}} \quad (3)$$

$$\text{where } H_{sys} = \sum_{i=1}^N H_i M_{Base_i} \quad (4)$$

If IACE is to be added using the weight option:

$$ACE = ACE * (1 - IACEweight) + IACE * IACEweight * IACEscale$$

Else:

$$ACE = ACE + IACE * IACEscale$$

Branch Power Flow calculated as

$$P = \frac{V_R V_S}{X} \sin(\delta_S - \delta_R) \quad (5)$$

$$Q = \frac{V_R}{X} (V_S \cos(\delta_S - \delta_R) - V_R) \quad (6)$$

$$S = P + jQ \quad (7)$$

$$Amps = \frac{|S|}{V_S \sqrt{3}} \quad (8)$$

$$\text{where } V_S, V_R \text{ are magnitudes.} \quad (9)$$