



# **Load Frequency Control (LFC)**

**Power Sytem Control**

**Novalio Daratha**



# Chapter 12

## Load Frequency Control

SI EDITION

FIFTH EDITION

# POWER SYSTEM

## ANALYSIS & DESIGN

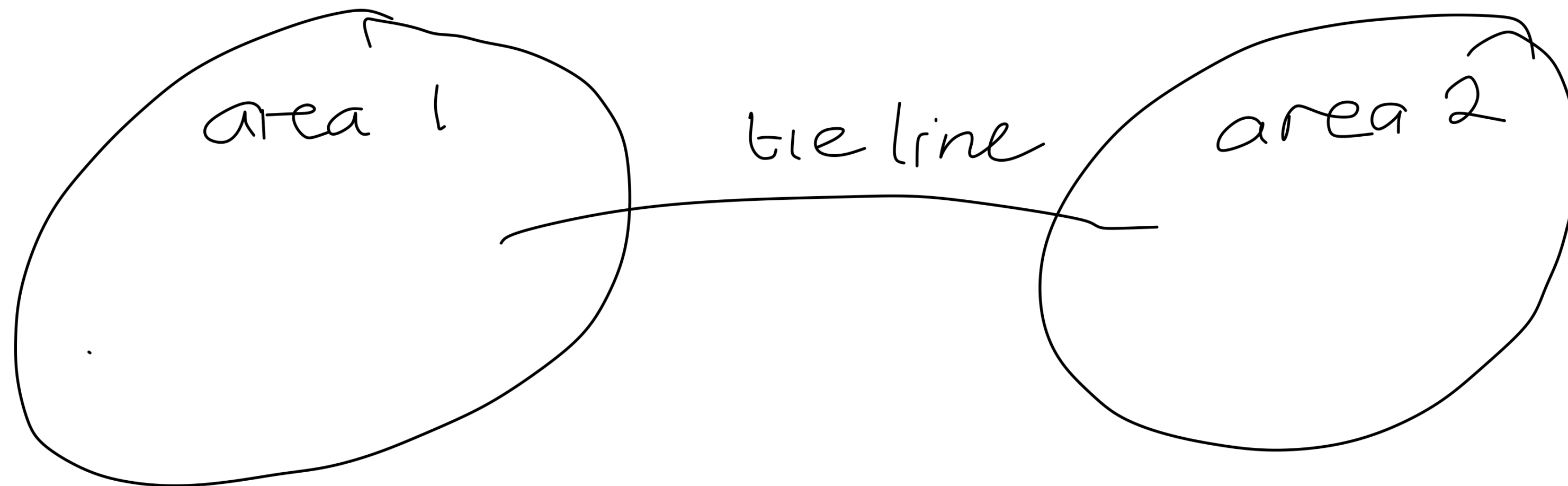
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# Objective of LFC



- Used in a power system with interconnected area. Example S2JB + Lampung
- $\Delta f = 0$ , each area must participate to nullify error in frequency
- Each area must supply its own load





# LFC

## AREA CONTROL ERROR (ACE)

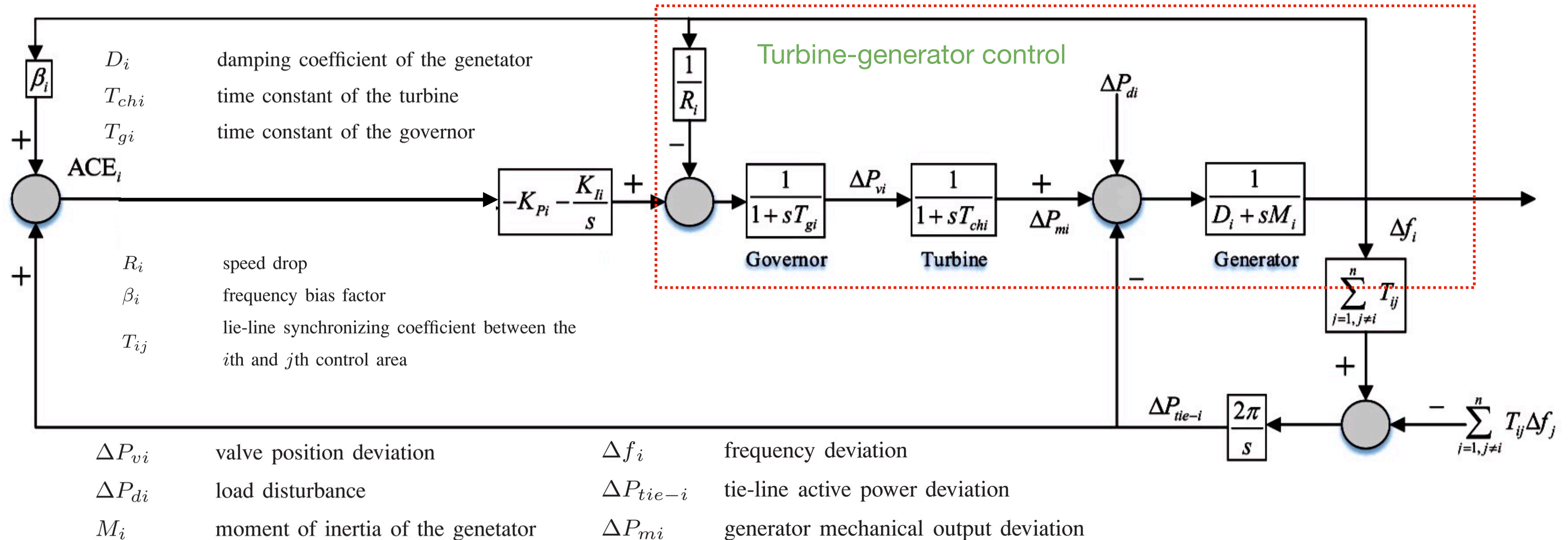
- $ACE_i = (p_{tie} - p_{tie,sched}) + B_f(f - 50) = \Delta p_{tie} + B_f \Delta f$
- Area control error = error in power export via tie line + error due to frequency
- LFC makes ACE zero.
- It means power export is as scheduled and frequency is 50 Hz
- LFC command new power reference to turbine-generator control (TGC) every 2s or more.

# LFC + TGC

## BLOCK DIAGRAM, PI control



LIU *et al.*: EVENT-TRIGGERED  $H_\infty$  LFC FOR MULTIAREA POWER SYSTEMS UNDER HYBRID CYBER ATTACKS





# Quiz

## Multiarea, TGC, no LFC

### SECTION 12.3

- 12.14** A 60-Hz power system consists of two interconnected areas. Area 1 has 1200 MW of generation and an area frequency response characteristic  $\beta_1 = 600$  MW/Hz. Area 2 has 1800 MW of generation and  $\beta_2 = 800$  MW/Hz. Each area is initially operating at one-half its total generation, at  $\Delta p_{\text{tie1}} = \Delta p_{\text{tie2}} = 0$  and at 60 Hz, when the load in area 1 suddenly increases by 400 MW. Determine the steady-state frequency error and the steady-state tie-line error  $\Delta p_{\text{tie}}$  of each area. Assume that the reference power settings of all turbine-governors are fixed. That is, LFC is not employed in any area. Neglect losses and the dependence of load on frequency.

# Quiz 2

## Multiarea, LFC partial, LFC full

- 12.15** Repeat Problem 12.14 if LFC is employed in area 2 alone. The area 2 frequency bias coefficient is set at  $B_{f2} = \beta_2 = 800$  MW/Hz. Assume that LFC in area 1 is inoperative due to a computer failure.
- 12.16** Repeat Problem 12.14 if LFC is employed in both areas. The frequency bias coefficients are  $B_{f1} = \beta_1 = 600$  MW/Hz and  $B_{f2} = \beta_2 = 800$  MW/Hz.





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Power Sytem Control

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