Process Control

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Theme: Measurement Control Instrumentation and Communication (pneumatic).

Summary

- Wide range of applications
  - Regulation of many different variables
  - Automation of start up and shut down
- Separation of sensing, actuation and control laws
  - Longevity of the pneumatic inheritance: structure and parameters (old technology in new clothes)
- Better freedom in implementing controllers
- Standardization of communication and interfaces pneumatic 3-15 psi
  - Centralized control rooms (relay and control cabinets)
  - Decentralized control with centralized displays
- Marginal theory development
- Extensive development of tuning and FOTD model
- Extensive industrialization control companies
- Leadership moved from Europe to the US

Problem

Bennet page 51: *Ivanoff used empirically determined values to represent gain and phase of the temperature wave passing through the plant (he assumed that both gain and phase were functions of the square root of the frequency and were of equal value) and showed that the permissible maximum controller gain is 23.1 ... He called this result surprising.*

$$P(s) = e^{-\sqrt{sT}}, \qquad \log P(i\omega) = -\sqrt{i\omega T} = -\frac{1}{\sqrt{2}}\left(\sqrt{\omega} + i\sqrt{\omega}\right)$$

Critical frequency

$$\frac{1}{\sqrt{2}}\sqrt{\omega} = \pi, \qquad P(i\omega_c) = -e^{-\pi}, \qquad k_c = e^{\pi} = 23.1407$$

Problem