Model MATEMATIK

D: Control Algorithm

T = periode cuplik (sampling period) konstan ditentukan oleh clock

Isyarat Digital (DATA)

k	r(k)	y(k)	e(k)	u(k)
0	r(0)	y(0)	-e(0)	u(0)
1	r(1)	y(1)	e(1)	u(1)
2	r(2)	y(2)	e(2)	u(2)
3	r(3)	y(3)	e(3)	u(3)

S/H D/AC A/D

T: mathematical switch menutup selama waktu yang sangat singkat setiap periode T (pencuplik, sampler)

ZOH: zero Order Hold (Penahan Order Nol)

infinitesimal

monitor

Transformasi Z:

pencuplik semu (virtual sampler)

Transfer Function

MODEL NISBAH ALIH

MINICOMPUTER

MICROCOMPUTER (PC-based)

s/d 1980-an MICROCONTROLLER

laptop

mobile programming

(Empat) periode sejarah perkembangan SISTEM KENDALI DIGITAL menurut Astrom & Wittenmark [1984]

* Jaman PERINTIS ~1955 → Texaco + TRW
* Jaman DDC ~1962 → DCC + Ferranti Argus
* Jaman MINIKOMPUTER ~1969
* Jaman MICROCOMPUTER ~1972 (PC)

s/d 1984

dari 1984 s/d sekarang:

* Jaman MICROCONTROLLER [~1980]
* Jaman PLC → DCS → APC
* selajutnya: * NANO TECHNOLOGY → Biology

ENIAC

PDC

Proses ICI → Produk

129 katup

22 4 variabel

OPEN/CLOSE

Ferranti Argus Computer

Program

MTBF 1000 jam

"MIPS" Million Instruction per Second

lambat dan mudah rusak

MTBF: Mean Time Between Failure 50–100 hours

"PROGRAM"

PLC = Programmable Logic Controller

DCS = Distributed Control Systems ← LAN

APC = Advanced Process Control

AI

"Smart Tech..."

* Sejarah SISTEM KENDALI DIGITAL

⇒ PDII (1939–1945)

* POLYMERISASI

TexasRefinery → penyulingan minyak Port Arthur, TX

Maret 1956 → otomatisasi untuk pengukuran Temp, Level, Pressure

TRW → aerospace company

Maret 1959

TRW-300

Set point

Rangkaian PENJUREDAN

ON/OFF

5 REACTOR

22 flows
72 temperatur
3 tekanan
3 pencampuran bahan

Residu Pemaling BBM

104 pengukur (sensor)

polymer

Apa fungsi SKD ???

program

SISTEM KENDALI DIGITAL

2 SKS 16x pertemuan (termasuk MID & FIN)

1 SKS * Praktikum INDIVIDU

* Praktikum KELOMPOK → LSKI

Course website http://www.unhas.ac.id/rhiza/teaching/kuliah/sistem-kendali-digital

Referensi "Computer-controlled Systems" [1984] Astrom & Wittenmark

Penilaian: [MID, FIN, Praktikum Kelompok, Praktikum Individu]

Materi:

* PENDAHULUAN: Intro to Digital Control Systems
* PEMODELAN: Digital Control Systems Modelling
  * Transfer Function
  * State Space
* ANALISIS & DESAIN: Digital Control Systems Analysis & Design

Bab I PENDAHULUAN

Introduction to the Digital Control Systems

Sistem Kendali Digital

Nama² lain English	Bab Indonesia
(1) Discrete-time Control Systems	Sistem Kendali Waktu Diskrit
(2) Sampled-Data Control Systems	Sistem Kendali Data Tercuplik
(3) Computer-controlled Systems	Sistem (dari) Kendali (Kan oleh) Komputer

Sistem Kendali

Setting Comm ana ACUAN → Pengendali (CONTROL-LER) → Kendali Control → Kendalian (PLANT) → output

umpan balik feedback → SENSOR

SISTEM KENDALI DIGITAL:

Control → DIGITAL CONTROLLER (pengendali digital) → Kendali Control → Kendalian (PLANT) PROSES → output

umpan balik feedback → SENSOR

Mac Monitor "Interface" (MMI)

* Pengetahuan untuk mempelajari (SKD):
  1. Pengetahuan ttg. PROSES
  2. Pengetahuan ttg. Teknologi (Komputer) DIGITAL
  3. Pengetahuan ttg. INSTRUMENTASI
  4. Teori KENDALI

BAB II PEMODELAN SKD:

DIGITAL: mikrokon acuan; setting; command

PENGENDALI DIGITAL (digital controller) dalam SEGMA BENTUKNYA

DIGITAL → D/A → ANALOG → AKTUATOR → PROSES (kendalian) → ANALOG OUTPUT (keluaran)

DATA DIGITAL ← A/D ← ANALOG ← SENSOR

clock

KONVERSI

KENDALIAN PROSES (process plant)

DIGITAL ANALOG

Figure 1.1 hal. 2

MODEL MATEMATIK

r(k) → e(k) → program → u(k) → A/D → u(t) → Proses → y(t) → sensor → y(k)

clock

y(k) → D/A → y(t)

Macam² PENGENDALI DIGITAL:

* GERBANG LOGIKA: NOT, AND, OR, NAND, NOR, XOR...
* RANGKAIAN LOGIKA:
  * Kombinatorik: HA, FA,
  * Sekuensial: flip-flop, counter, register, dll
* PROSESSOR ⇒ MICRO CONTROLLER
* PLC, DCS, APC...
* KOMPUTER → PC
* JARINGAN KOMPUTER