Příklady průmyslových PID regulátorů a jejich struktury

2.3.1 Ideal PID controller structure and its variations

Ideal

$$G_C(s) = K_c\left(1+\frac{1}{T_i s}+T_d s\right)$$

or

ideal parallel

$$G_C(s) = K_c+\frac{1}{T_i s}+T_d s$$

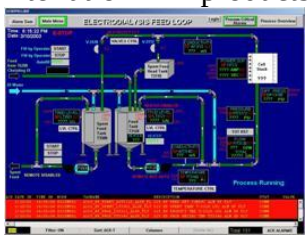
The controller structure is used in the following products:

(a) Allen Bradley PLC5 product (McMillan, 1994)

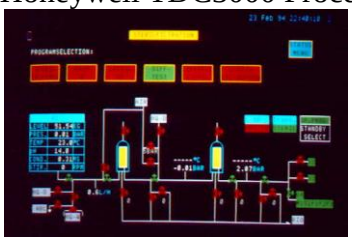
(b) Bailey FC19 PID algorithm (EZYtune, 2003)

(c) Fanuc Series 90-30 and 90-70 independent form PID algorithm (EZYtune, 2003)

(d) Intellution FIX products (McMillan, 1994)



(e) Honeywell TDC3000 Process Type A, non-interactive mode product (ISMC, 1999)



(f) Leeds and Northrup Electromax 5 product (Åström and Hägglund, 1988)

(g) Yokogawa Field Control Station (FCS) PID algorithm (EZYtune, 2003)

Controller with filtered derivative

$$G_C(s) = K_c\left(1+\frac{1}{T_i s}+\frac{T_d s}{1+\frac{T_d s}{N}}\right)$$

This structure is used in the following products:

(a) Bailey Net 90 PID error input product with N = 10 (McMillan, 1994) and FC156 Independent Form PID algorithm (EZYtune, 2003)

(b) Concept PIDP1 and PID1 PID algorithms (EZYtune, 2003)

(c) Fischer and Porter DCU 3200 CON PID algorithm iwth N = 8 (EZYtune, 2003)

(d) Foxboro EXACT I/A series PIDA product (in which it is an option labelled ideal PID) (Foxboro, 1994)

(e) Hartmann and Braun Freelance 2000 PID algorithm (EZYtune, 2003)

(f) Modicon 984 product with $2 \leq N \leq 30$ (McMillan, 1994; EZYtune, 2003)

(g) Siemens Teleperm/PSC7 ContC/PCS7 CTRL PID products with N = 10 (ISMC, 1999) and the S7 FB41 CONT_C PID product (EZYtune, 2003)

2.3.2 Clasical PID controller structure and this variations

Classical (cascade, interacting, series)

$$G_C(s) = K_c\left(1+\frac{1}{T_i s}\right)\frac{1+T_d s}{1+\frac{T_d s}{N}}$$

The structure is used in the following products:

(a) Honeywell TDC Basic/Extended/Multifunction Types A and B products with N = 8 (McMillan, 1994)

(b) Toshiba TOSDIC 200 product with $3.33 \leq N \leq 10$ (McMillan, 1994)

(c) Foxboro EXACT Model 761 product with N = 10 (McMillan, 1994)

(d) Honeywell UDC6000 product with N = 8 (Åström and Hägglund, 1995)
(e) Honeywell TDC3000 Process Manager product – Type A, interactive mode with N = 10 (ISMC, 1999)
(f) Honeywell TDC3000 Universal, Multifunction and Advanced Multifunction products with N = 8 (ISMC, 1999)
(g) Forboro EXACT I/A Series PIDA product (in which it is an option labelled series PID) (Foxboro, 1994)

Series

$$G_C(s) = K_c\left(1+\frac{1}{T_i s}\right)(1+T_d s)$$

The structure is used in the following products:

(a) Turnbull TCS6000 series product (McMillan, 1994)

(b) Alfa-Laval Automationj ECA400 product (Astrom and Hagglund, 1995)
(c) Foxboro EXACT 760/761 product (Astrom and Hagglund, 1995)

Interacting

$$G_C(s) = K_c\left(1+\frac{1}{T_i s}\right)\left(1+\frac{T_d s}{1+\frac{T_d s}{N}}\right)$$

This structure is used in the following products:

(a) Bailey FC156 Classical Form PID product (EZYtune, 2003)
(b) Fisher and Porter DCI 4000 PID algorithm (EZYtune, 2003)

2.3.3 Non-InteractionPID controller structure and this variations

Non interacting

$$U(s) = K_c\left(1+\frac{1}{T_i s}\right)\left(E(s)+\frac{T_d s}{1+\frac{T_d s}{N}}Y(s)\right)$$

This structure is used in the following products:

(a) Bailey, Fisher and Porter 53SL6000 and 53MC5000 products with N=0 (ISMC, 1999)
(b) Moore Model 352 Single-Loop Controller product (Wade 1994)

Non interacting 2DOF

$$U(s) = K_c\left(1+\frac{1}{T_i s}+\frac{T_d s}{1+\frac{T_d s}{N}}\right)E(s) - K_c\left(\alpha+\frac{\beta T_d s}{1+\frac{T_d s}{N}}Y(s)\right)R(s)$$

This structure is used in the following products:

(a) Bailey Net 90 PID PV and SP product (McMillan 1994)
(b) Yokogawa SLPC products with $\alpha=-1, \beta=-1, N=10$ (McMillan 1994)
(c) Omron E5CK digital controller $\beta=-1, N=3$ (ISMC, 1999)

Non interacting

$$U(s) = K_c\left(1+\frac{1}{T_i s}\right)E(s) - K_c T_d s Y(s)$$

This structure is used in the following products:

(a) ABB 53SL6000 Product (ABB, 2001)
(b) Genesis product (McMillan, 1994)
(c) Honeywell TDC3000 Process Manager Type B, non-interactive mode product (ISMC, 1999)
(d) Square D PIDR PID product (EZYtune, 2003)

2.3.4 Other PID controller structures

Industrial controller

$$U(s) = K_c\left(1+\frac{1}{T_i s}\right)\left(R(s) - \frac{1+T_d s}{1+\frac{T_d s}{N}}Y(s)\right)$$

This structure is used in the following products:

(a) Fisher-Rosemount Provox product with N = 8 (ISMC, 1999; McMillan, 1994)
(b) Foxboro Model 761 product with N=10 (McMillan, 1994)
(c) Fisher-Porter Micro DCI product with N = 0 (McMillan, 1994)
(d) Moore Products Type 352 controller with $1 \le N \le 30$ (McMillan, 1994)
(e) SATT Instruments EAC400 product with N=8.33 (McMillan, 1994)
(f) Taylor Mod 30 ESPO product with N=16.7 (McMillan, 1994)
(g) Honeywell TDC3000 Process Manager Type B, interactive mode product with N = 10 (ISMC, 1999)

$$U(s) = \frac{K_c}{T_i s}R(s) - K_c\left(1+\frac{1}{T_i s}\right)\left(\frac{1+T_d s}{1+\frac{T_d s}{N}}\right)Y(s)$$

This structure is used in the following products:

(a) Honeywell TDC3000 Process Manager Type C, interactive mode product with N = 10 (ISMC, 1999)
(b) Honeywell TDC3000 Universal, Multifunction and Advanced Multifunction products with N = 8 (ISMC, 1999)

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