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Author	佐伯, 浩人(Saeki, Hiroto)
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Adaptive Control of Intercrossed High Order Systems

Hiroto SAEKI*

This is the repporting that is recollected as the master thesis originated from the series "Adaptive Principle and It's Application" and other miscillaneous reportings which have been written by the auther extendingpast one year. The contents consist of two essential parts, namely, "An Adaptive System Synthesis with a Lag-Lead Network as the Adaptive Model" and "Adaptive Control of Intercrossed High Order Systems."

In the first part, a case that the process has first order plus dead time system is treated and attention is focused on the relation of

$$e^{-Ls}=\lim_{n\to\infty}\frac{1}{\left(1+\frac{Ls}{n}\right)^n} \tag{1}$$

Transfer function of the process is approximated as

$$G(s)\fallingdotseq\frac{K}{(1+Ts)(1+Ls)} \tag{2}$$

and $G_c(s)$ as transfer function of controller

$G_m(s)$ as transfer function of model.

Then, the model error transfer function can be written with respect to $G_m(s)/G(s)$, performing bandpass filter, when $G(s)$ and $G_m(s)$ have the same functional form, so that the process parameters are noticed according to the frequency characteristics.

The author also shows the relation between parameters in the case that the process dynamic response, specified proportional control, has 25 percent damping ratio by Ziegler and Nichols' criterion.

In the second part intercrossed system is focused on to be same characteristic function at each closed-loop systems.

Considering energy density spectrum in the error signal, a frequency servo is used in order to maintain the closed-loop poles into the desired position. The dominant closed-loop poles are those resulting from the pole near the origin and the complex pair, so that the approximate transfer function for high order system is obtained. Compensator is prepared before the frequency servo prevents from over action of gain adjustment.

The auther gives applications, which are an axial flow blower for the part one, and

*佐 伯 浩 人

lateral and directional motion of airplane for the part two, and also shows each transfer functions.

Moreover, analogue simulations are now under preparation for these examples, and they should be reported in the near future.