Analysis on Intellectual Technology in Electronic Engineering Automation Control

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Abstract: Intellectual technology has higher precision sensing technology, meanwhile the main function of this kind of technology is indicated in improving working environment and load of operators, so that it can further enhance working efficiency and quality of operators, people will apply intellectual technology in plenty of electronic engineering automation control. Therefore, this paper makes discussion on intellectual technology of electronic engineering automation control.

1. Introduction

With the gradual development of economy in China, application speed of intellectual technology in electronic engineering automation control becomes increasingly fast, but it has many intellectual technology problems in electrical engineering industry at present. So in order to make intellectual technology gradually improve, we can apply artificial intellectual technology into electronic engineering automation control to meet future production demand by combining intellectual technology.

2. Analysis on intellectual technology in electronic engineering automation control

2.1. Analysis on automation updating of electronic engineering

Industry updating means the dynamic conversion process of industry continually enhances in screw type from low level and low quality to high level and high quality, it includes industry converts from low technology to high technology, industry element endowment converts from elementary labor force and natural resources to senior human resources, technology, knowledge, product converts from low technology to high technology and intelligence, industry value chain converts from low part and continually climbing to high level, which is indicated by table 1:

Table 1 4 kinds of types of industry updates from low level to high level

perspect type	low level	high level
industry technology degree	low technology	high technology
industry element	labor force, natural resources etc	human resources, technology, knowledge,
product produced by industry	low technical content	high technical content, intelligence
indystry value chain	low-end, low added-value part	high-end and high added-value part

Table 2 Comparison of traditional large-scaled production and large-scaled custom-made

project	large-scaled production	large-scaled custom-made
management idea	focuses on product	centralized on customers
drive way	predict production by market(push type)	arrange production by customer demand (pull type)
core	ensure by stability and control ability	realize diversified and custom-made by flexible and quick response
strategy	high efficiency	difference strategy
target	strategy of cost leading	by diversified and custom-made develop, produce and deliver satisfied product and service to customers
applicable range	by low price to open, produce, distribute and deliver product and service	demand dynamic change, diversified segment market

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2.2. Application analysis of PLC technology

PLC is researched under this background, this kind of new control equipment adopts micro-procession technology and chip technology, CPU adopts storage equipment with programmable program, it uses rich operation command circuit including timing, technology, calculation, logic etc, which can realize industry automation site to control analog signal and digital signal control.

Figure 1 PLC of Mitsubishi series

Characteristics of expert PID control, the working principle of expert PID control is to make analysis on special control object according to every kind of knowledge and rule of expert base and knowledge base, it uses expert experience to make PID parameter design. The advantage of this kind of control system lies in that it dose not need to know precise model of controlled object. Figure 2 is one kind of typical 2-phase system unit step-hop response error curve; it makes the following analysis on 2-phase system step-hop response:

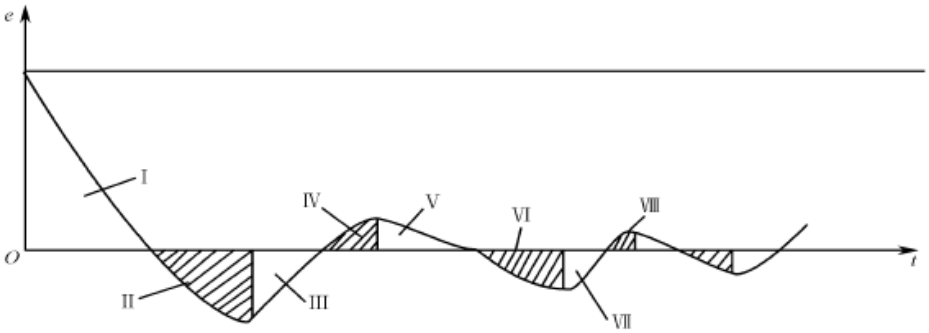

Figure 2 Step-hop response error curve of typical 2-phase system unit

When the whole system parameter is dispersed, of which e is the error value of sampling time, e(k -1) and e(k-2) is the error value of current sampling, so it gets the following:

$$\triangle e(k)=e(h)-e(k-1)$$

$$\triangle e(k-1)=e(h-1)-e(k-2)$$

It adopts {e(k), 4e(k), 4e(k -1)}as feature vector. According to error change of control system and error range M1 ,M2 , and$\varepsilon M_1 > M_2$ $\varepsilon \rightarrow 0$,it can divide design of expert PID controller into 5 kinds of conditions and make analysis:

The first one,when e(k)> M,error is very large at this time, it should maximize or minimize output when designing controller, so it can quickly adjust error and reduce error. At this time, it is equivalent to open-loop control.

The second one,when e(k) ×△e(k)>0 or △e(k)=0,there are 2 kinds of conditions at this time, the first one is error is gradually increasing, the second one is error is maintained in certain level without any change. When e认)>M2,it indicates error absolute is very large and is gradually enlarging or unchanged, generally speaking, error is very large, here it should make PIN controller output stronger control parameter, so that it makes error absolute quickly reduce, here the out put can be designed as

follows:

$$u(k)=u(k-1)+k1\{kp[e(k)-e(k-1)]\}+ki\ e(k)+kd[e(k)-2e(k-1)+e(k-2)]$$

When $e(k)<M_2$,here error absolute is not so large, so expert PID controller can output some common actions, only error absolute of error reduces direction change, controller output can be designed as follows:

$$u(k)=u(k-1)+kp[e(k)-e(k-1)]+ki\ e(k)+kd[e(k)-2e(k-1)+e(k-2)]$$

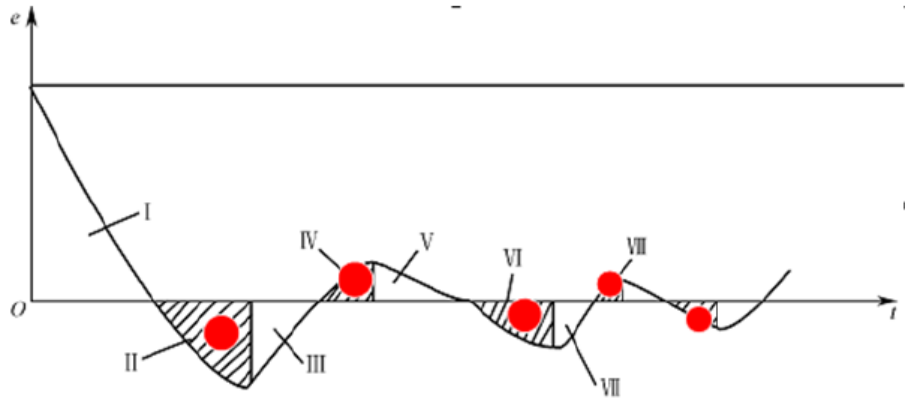

Figure 3 2-phase system step-hop response error curve under rule 2

The third one, when $e(k) \times 4e(k) < 0$, $4e(k) \times 4e(k-1) > 0$ or $e(k)=0$,at this time, error absolute becomes smaller, or it reaches balance state and error is 0. Output of expert PID controller is gradually reducing error, it adopts error maintain unchangeable.

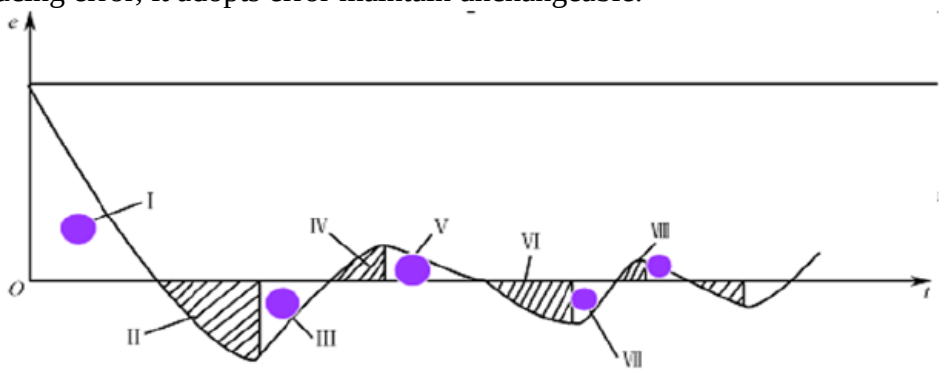

Figure 4 2-phase system step-hop response error curve under rule3

As it is indicated by figure 5, III, V area, error absolute is gradually reducing. So it can make expert controller maintain current output, it manes implementing open-loop control, II , IV , VI , VIQ ,…area, it chooses proper and stronger control action or common one, which can restrict increase of dynamic error.

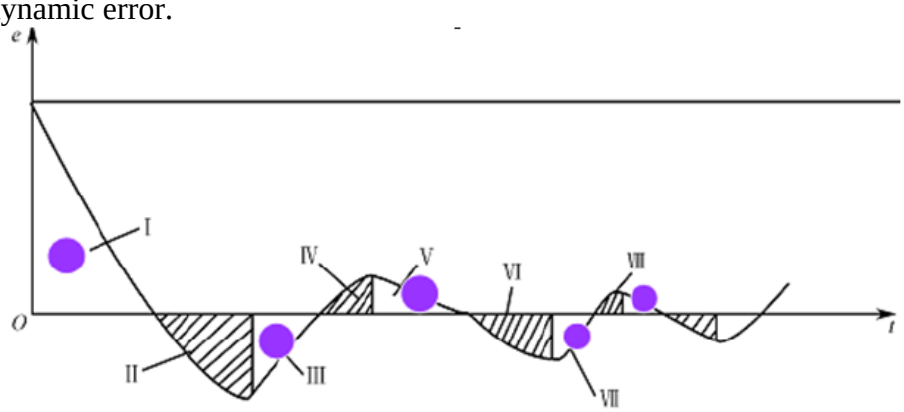

Figure 5 2-phase system step-hop response error curve under rule5

As for special example to make analysis, it makes analysis on the following typical 3-phase system: of which object sampling time is 1 ms. Design expert PID controller, in the simulation process, e chooses 0.001, 5 pieces of rules in program are corresponding to 5 situations of control algorithms.

It makes z conversion for the above-mentioned system transmission function and makes it dispersion:

```
ts=0.001;
sys=tf(5.235e005, [1,87.35,1.047e004,0]);
dsys=c2d(sys,ts,'z');
[num,den]=tfdata(dsys,'v');
```

programming is as follows:

```
% expert PID control
cle ar all;
clo se all;
ts=0.001;
sys=tf(5.235e005, [1,87.35,1.047e004,0]);
dsys=c2d(sys,ts,'z');
[num,den]=tfdata(dsys,'v');
%parameter initialization
u_1=O;u_2=O;u_3=O;y_1=O;y_2=O;y_3=0;
x=[0,0,0]';x2_1=0; error_1=0;
kp=0.6;ki=0.03;kd=0.01;
% control program
for k=1:1:_500
time(k)=k*ts;
r(k)=1.0;% given signal
u(k)=kp*x(1)+kd*x(2)+ki*x(3);   07oPID controller output
% expert control rule
if abs(x(1))>0.8%rule1: open-loop control
   u(k)=0.45;
elseif abs(x(1))>0.40
   u(k)=0.40;
elseif abs(x(1))>0.20
   u(k)=0.12;
elseif abs(x(1))>0.01
   u(k)=0.10;
end
   if x(1)*x(2)>01(x(2)==0)      07oRule2
   if abs(x(1))>=0.05
     u(k)=u_ 1+2 *kp *x(1);
   else
     u(k)=u_1+0.4*kp*x(1);
   end
end
if (x(1)*x(2)<0&x(2)*x2_1>0)I(x(1)==0)   07oRule3
   u(k)=u(k);
end
if x(1)*x(2)<0&x(2)*x2_1<0   07oRule4
   if abs(x(1))>=0.05
     u(k)=u_ 1+2 *kp *error_ 1;
   else
     u(k)=u_ 1+0.6 *kp *error_ 1;
   end
```

```
end
if abs(x(1))<=0.001   07oRuleS:Integration (separation PI control)
      u(k)=0.5*x(1)+0.010*x(3);
   end
   %definition of  controller output
   if u(k)>=10
      u(k)=10;
   end
   if u(k)<=-10
      u(k)=-10;
   end
   % dispersed model
   y(k)=-den(2)*y_1-den(3)*y_2-den(4)*y_3+num(1)*u(k)+num(2)*u_1+num(3)*u_2+
m(4)*u_3;
   error(k)=r(k)-y(k);
   %------process parameter updating process parameter updating------- %
   u_ 3=a_ 2;u_2=u_l;u_1=u(k);
   Y-3=y_2;y_2=y_1;y_1=y(k);
   x(1)=error(k);%Calculating P
   x2_1=x(2);
   x(2)=(error(k)-error_1)/ts;%Calculating D
   x(3 )=x(3 )+error(k) *ts;%Calculating I
   error_1=error(k);
   end
   % simulation result output
   figure(1);
   plot(time,r,'b',time,y,'r');
   xlabel('time(s)');ylabel('r,y');
   figure(2);
   plot(time,r-y,'r');
   xlabel('time(s)');ylabel('error');
```

It gets the following simulation result:

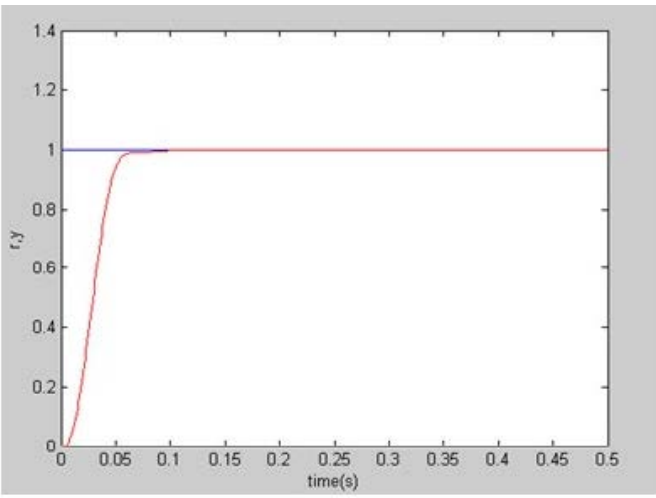

Figure 6 Step-hop re4sponse curve under control of expert PID control effect

3. Advantages of adopting intellectual technology in electronic engineering automation control

3.1. Simple design

Before traditional electronic engineering realizes automation control, it needs to make practice

operation in pre-trial period, it will adopt model pre-trial method to test some problems appear in automation control process and notes in most situations, people will gradually know how to improve mechanic design when it appears unstable state in many times of practice operation, it can reduce difficult degree of designers in designing mechanic automation control simulator, which makes the whole design much more simple.

3.2. Simple operation process

According to survey, actual operation and procedure is relatively complicated, especially for many times of program test, it can timely find and improve some unqualified product or products with defects, produce product with high quality by their own professional technology. Application of intellectual technology also reduces requirement of professional personnel and simplifies operation procedure, meanwhile it saves output of human resources, and it has positive effect for development of electronic engineering enterprises.

3.3. Overall consistency

The overall systematic control is one kind of effective control way for mechanic automation production; intellectual control can realize higher commercial value compared with traditional mechanic control. Overall consistency can guarantee consistent production time and rest time; it can control some machines with long time period, which makes convenient of enterprise management.

4. Detailed application of electronic engineering automation control

(1) Effectively eliminate system fault. By using intellectual technology, it can effectively eliminate system fault of electronic engineering automation control and greatly enhance fault diagnosis level. By applying fuzzy logic control technology, neutral network technology, expert system control technology, this provides huge convenience for personnel to make system maintenance.

(2) Optimizing electronic equipment design. Electronic equipment is the important part of electronic engineering automation control system, while electronic equipment is one kind of complicated and professional system work, relevant design personnel mush have solid basic knowledge and rich design experience, flexibly apply every kind of theory knowledge.

5. Conclusions

With artificial intellectual technology applied in every kind of field as well as development and popularization of computer technology, it displays large space, especially in application of electrical automation, which enhances working efficiency and equipment quality.

References

[1] Jin Tao. Research on Intellectual Technology in Electrical System Automation Control [J]. Science and Technology Innovation Herald, 2017, 14(24):2-3.

[2] Lu Jingbo, Tang Peilin. Application Discussion on Intellectual Technology in Electrical Automation Control [J]. Electronic Technology and Software Engineering, 2014(11):260.

[3] Jiang Rongyi. Electrical Automation Control System Based on Intellectual Technology [J]. Internal Combustion Engine and Fittings, 2018(08):98.

[4] Shi Erna, Xiao Leilei. Artificial Intelligence Practice in Electrical Automation Control [J]. New Communication in China, 2018, 20(09):230.

[5] Hu Yingying, Leng Xue. Intellectual Technology Implements Electrical Automation Control [J]. Electronic Technology and Software Engineering, 2018(14):133.