

Recent Research of fluid power at Yanshan University

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ABSTRACT

In the paper ,I introduce the main recent research of the fluid power at Yanshan University. Including heavy machinery electrohydraulic servo-control system, pipe dynamic property , control strategy and intelligent fault diagnosis prediction Study on hydraulic components and application, Research on the complicated flow, The mechanics quantity detection and control technique.

Key words, control system, hydraulic components, flow power.

Brief Introduction for the research projects

1、Major direction in researches

- ◆ The research for the heavy machinery electrohydraulic servo-control system

We had an advanced breakthrough in strip thickness and shape control, thus we got independent of the imported finishing mill group technology. In 1992, we applied the fruits of researches on strip thickness to the 400HC rolling mill rebuilding of Harbin coppering steel strip company. Hence our country yielded precise steel strip by using our domestic technology and equipment for the first time.



Figure.1 The rolling mill

During the researching and the developing of IGC650HCW precise cold belt rolling mill equipment

sets, we initially realized the integration of the internal gorge Control (IGC) and the working-roll axial movement (HCW). The $\pm 2\mu\text{m}$ plating thickness control accuracy and the stable working situation enabled this technology to be the most advanced development among cold rolling control techniques. The Southwest Precision Strip Company built by this equipment sets has developed to be one of the ten key enterprise in XiChang of Panzhihua. In April,1997, the specialists of the national mechanics department ratified this result to be " in possession of originality, worldwide developed control accuracy and running conditions".

In 1999, the project was awarded a second class state scientific-technical progress prize. Moreover, the " research on continuous casting crystallizer non-sinusoidal oscillation system", one of the national " nine- five science and technology critical projects", received a second class scientific-technical progress prize of Hebei province.

- ◆ Research on pipe dynamic property

The theoretical analysis and experimental study about this project overthrew the traditional point of view that pipeline effect only can harm the systems, and revealed its potential application in electrohydraulic control systems. Besides, it put forward the new concepts and methods for series and parallel correction, and applied it to hydraulic bending system in rolling mill.

Therefore, the system band- width can increase three times (reached 60Hz), which was ratified to be in " international advanced lever " by the mechanics department.

- ◆ Research on hydraulic system control strategy and intelligent fault diagnosis prediction

It brought forward Fuzzy and Intelligent PID parallel control structure model, which was in possession of all merits of conventional PID, intelligent PID and fuzzy control. As long as it could go through input/output information in the real time detection on control procession, it could control systems effectively. So it is an useful and simple control strategy. The research on nonlinear system control chaos and the intelligent fault diagnosis prediction, has been a breakthrough in this field in recent years. It is of great importance in ensuring normal working of complicated electrohydraulic control systems and decreasing failure rate.



Figure.2 Diagnosis prediction of the hydraulic system

- ◆ Study on hydraulic components and application

The open circuit axial plunger pump has finished seven series new constructions. Its outstanding properties such as self-cooling, self-lubrication and no leakage, reduced the temperature increment of the pump, improved its service life for several times.

Received 2 national patents of invention

Received 8 national patents of utility model

Awarded a scientific-technical progress prize by mechanics department and " six five " critical technology

prize by Heilongjiang Province.

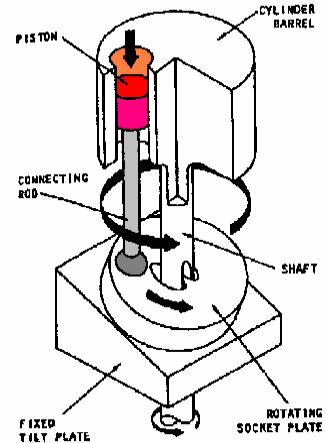


Figure.3 Axial plunger pump

- ◆ Research on the complicated flow

The traditional design is only dependent on experience because there is a lot of heterotype section complicated flow in hydraulic elements and it is too difficult to research flow fields with analytic methods. Adopting Navier - Stokes equation in finite element and boundary element analyzing heterotype section field, and leading-edge experimental research on flow field visualizing systems, this research searched after the energy loss mechanism of complicated flow field, to establish a foundation for optimum design of hydraulic elements.

- ◆ The mechanics quantity detection and control technique

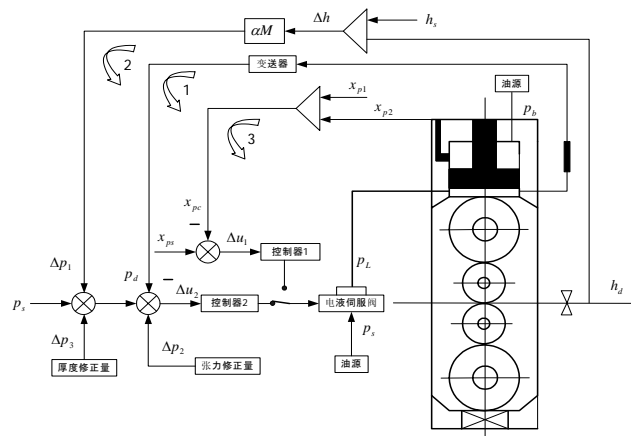


Figure.4 Diagram of the AGC system

Steel strip rolling mill shape control in cold rolling mill, the long-term national critical scientific research project, has yielded initiative results in theory and

practice. Some fruits of research, such as 650HCW shape of strip display system and 1850 cold rolling shape of strip plating thickness system control, has now been transferred into productivity. The successful research on magnetic and elastic transformer differential output cold rolling shape of s steel trip, filled up the domestic blank in this field, and enable us to get rid of the dependence on import. So it was awarded a first class and a second class scientific-technical progress prize by mechanics department.

2、 Part of the latest projects

- ◆ The critical technology research on the 1450 cold link rolling mill
- ◆ Programmable electrohydraulic control valve

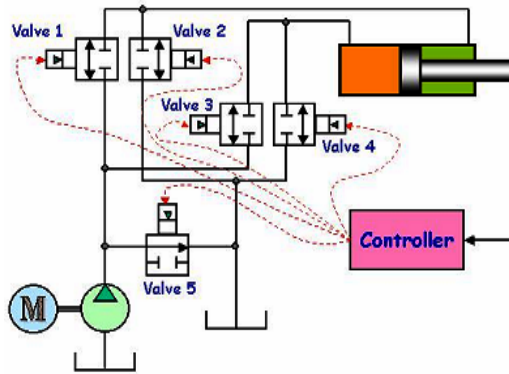


Figure.5 Programmable electrohydraulic control valve

- ◆ Virtual cold tandem rolling mill group Modelling and simulation

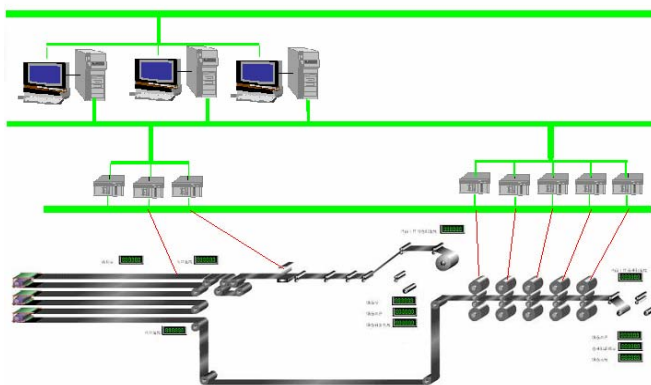


Figure.6 Virtual cold tandem rolling mill

- ◆ 1800 levelling machine shape of strip and extensibility syntheses optimization control



Figure.7 optimization control of the rolling mill

- ◆ Hot tandem roll reeling machine mark time control system



Figure.8 CPC system of the rolling mill

- ◆ Study on mutable width water curtain cooling experimental apparatus



Figure.9 Water curtain cooling system

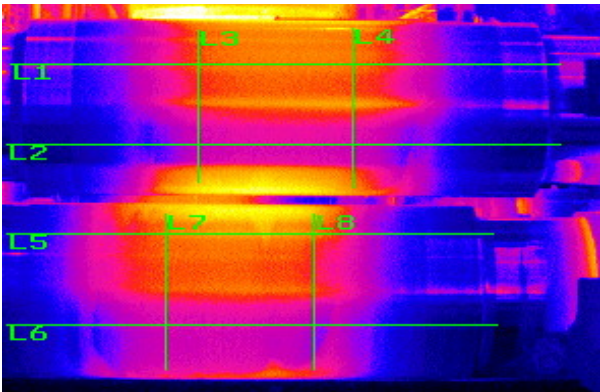


Figure.10 Temperature distribution of the strip steel.

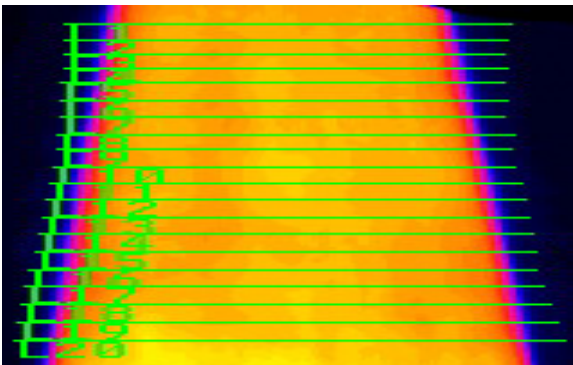


Figure.11 Temperature distribution of the strip steel.

◆ Study on control system of 5000T hydraulic press machine



◆ Figure.12 hydraulic press machine working spot

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