

YTF(S)- 500 远方跳闸信号传输装置技术特点分析

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【摘要】 YTF(S)- 500 型远方跳闸信号传输装置是在吸收西门子公司 SW T- 500F6 远方保护信号音频传输装置及 ESB 500 电力线复用载波机先进技术基础上, 研制而成的新一代的远方跳闸装置。该装置与目前国内的远方跳闸信号传输装置不同, 它能够同时传输两个相互独立系统的远方跳闸信号。该系统与复用保护系统的专用方式相比具有更高的安全性和可靠性。它采用了西门子公司专利技术: 键控移频 F6 调制技术以及脉冲噪声抑制技术。使该装置的安全性和可靠性得到了极大保证。

【关键词】 远方跳闸 安全性 可靠性 键控移频

引言

电力系统发生故障时, 为了保证系统的稳定运行往往要进行远方切机、远方电气制动、远方切负荷和远方调相改发电等实时操作, 这种操作方式往往要用远方跳闸信号传输装置来完成。目前, 西方发达国家远方跳闸信号的传输多采用复用电力线载波的方式, 这种运行方式比较经济, 不仅可以节省设备, 而且可以解决电力系统频带日益拥挤的问题。另外, 可以借助于光纤、微波、音频电缆等通道, 用音频保护信号传输设备来传输远方跳闸信号。尽管如此, 由于专用型远方跳闸信号传输装置有更高的安全性和可靠性, 因此, 在国内电力系统中, 仍作为一种主要的保护方式, 得到了广泛应用。

远方跳闸作为一种直跳式保护方式与允许和闭锁式相比要求有更高的安全性。因此, 在远方跳闸信号的接收端往往要增加故障启动元件来提高安全性。目前, 许昌继电器研究所已成功地研制出微机型故障启动装置, 已成为远方跳闸装置的理想搭档。

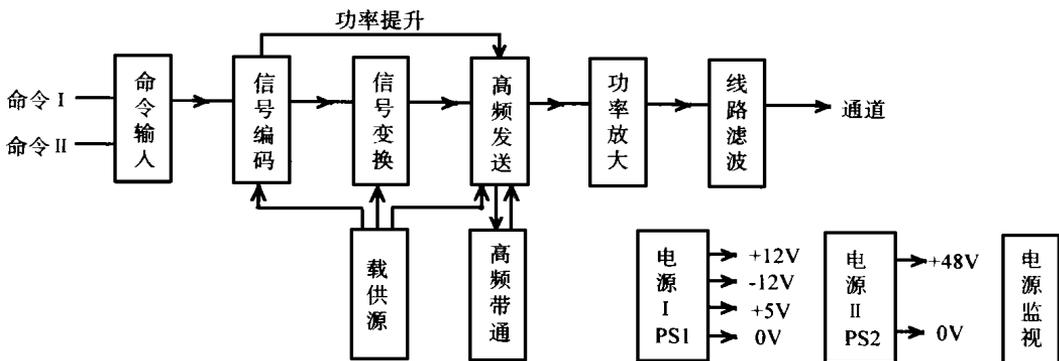


图 1 YTF- 500 原理框图

1 YTF(S)- 500 总体构成

YTF(S)- 500 型机分为发信机 YTF- 500 和收信机 YTS- 500 两个部分, 分别安装于线路两侧, 其原理框图见图 1, 图 3。

平时无跳闸信号命令输入时,发信装置发送低功率的监频信号 $f_G = f_0 - 1.5\text{kHz}$ (f_0 为工作频率),当有跳闸信号命令输入时,以满功率发送相应的跳闸信号频率。

系统 I 对应的跳闸信号频率: $f_1 = f_0 + 1.5\text{kHz}$

系统 II 对应的跳闸信号频率: $f_2 = f_0 - 0.5\text{kHz}$

系统 I + II 对应的跳闸信号频率: $f_3 = f_0 + 0.5\text{kHz}$

其 4kHz 带宽内频谱安排见图 2。

接收装置从通道上接收到的高频信号,通过隔离、滤波、解调,从中频带通滤波器取出中频信号。然后送入“信号判别”组件进行放大和限幅,以及信号处理并经“信号解码”组件解码,输出相应的跳闸命令信号。

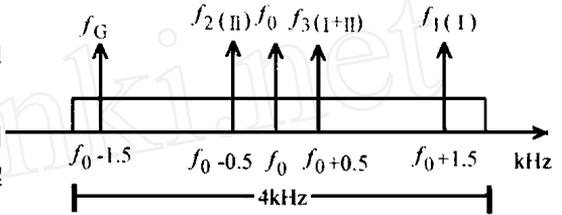


图 2 工作频带内频谱安排

2 YTF(S) - 500 技术特点分析

2.1 本装置采用西门子专利技术: F6 键控移频调制技术

平时通道中只传输低功率的监频信号频率。监频信号不仅实现对通道及设备的连续监视,而且还作为命令输出的闭锁信号,只要监频信号存在就不会有跳闸命令信号输出。通道中每次只能发送 4kHz 带宽内四种信号(f_G, f_1, f_2, f_3)中的一种信号频率,因此这种调制方式也叫“四出一”方式。

这种工作方式可以充分地利用发送机的发送功率,通过提升功率来提高跳闸信号的传输能力,增加可靠性。

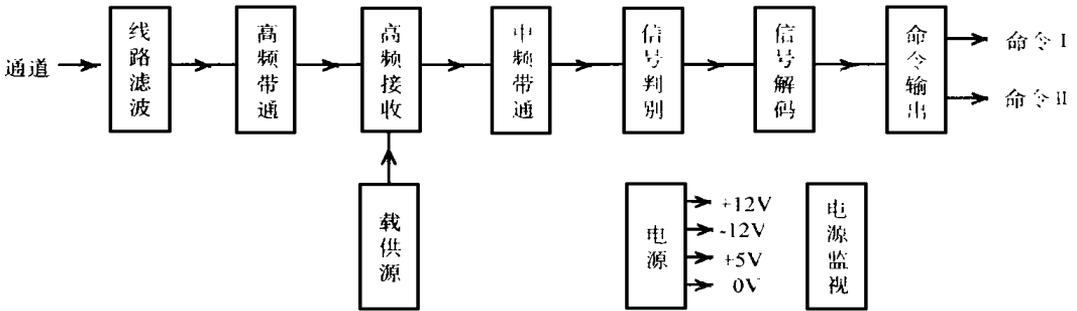


图 3 YTF- 500 原理框图

2.2 由于采用了编码技术,不仅实现了多命令信号的传输,而且使命令信号传输的可靠性和安全性有更进一步的提高。

2.3 各种信号的产生,靠内部代码控制分频器分频,经D/A 转换,低通滤波器滤波产生。因而有频率精度高,可靠性高,移频转换速度快等优点。其原理方框图见图 4。

2.4 发信装置功放电路由电源 PS2 单独供电,功率提升时对其它供电回路无影响,增加了发信装置的可靠性。

2.5 平时通道中传送+ 34dBm 的监频信号,当传输跳闸信号时,功率提升到+ 43dBm,能适应于各电压等级线路运行的需要。

2.6 跳闸信号传输时间不大于 20ms。

2.7 采用了西门子技术制造的滤波器,保证了并机运行的要求。

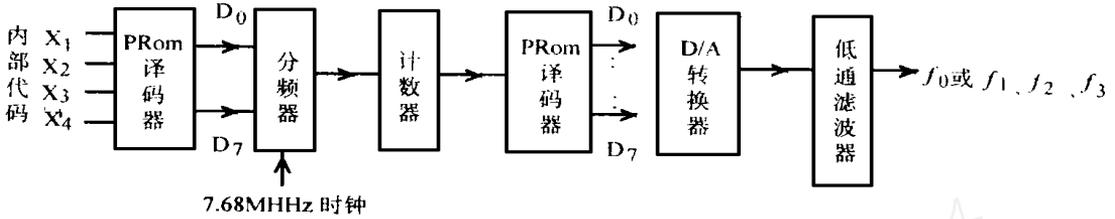


图 4 信号变换原理框图

2.8 接收支路采用了西门子公司 SW T 500F6 高频保护设备中的脉冲噪声抑制技术, 提高了装置的安全性。主要体现在“信号判别”组件(见图 5), 它包括以下几个方面:

- (1) 采用了 IAMB 抗脉冲噪声技术: 即在传送键控移频信号的情况下, 通过宽带滤波、限幅再进行窄带滤波, 可以对脉冲干扰进行有效地抑制。
- (2) 采用了导频闭锁回路。当有导频信号存在时, 将闭锁命令出口, 防止误跳闸。
- (3) 采用了信噪比闭锁措施, 当噪声检测电路检测到的信号噪声达到一定程度时, 将闭锁跳闸出口。
- (4) 采用“四出一”编码检测电路, 当包络检波器同时有两个或两个以上高电平信号出现时, 将闭锁跳闸出口。
- (5) 收信回路加入延时回路。在突发或间断出现的短暂干扰出现时, 由于延时回路来不及动作, 不会造成误输出, 提高安全性。

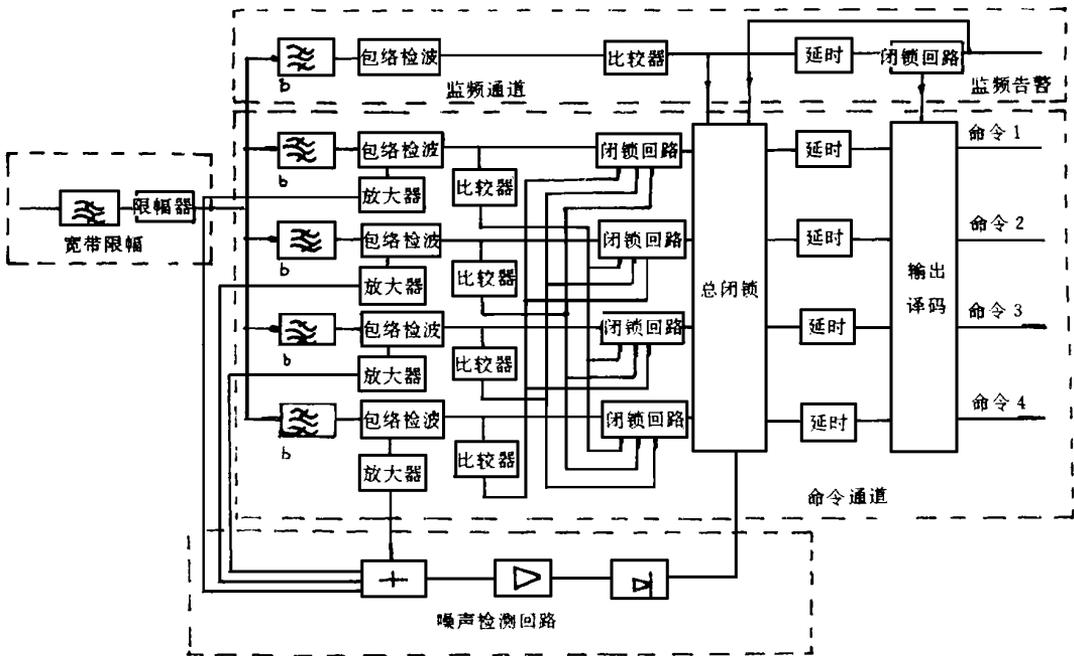


图 5 信号判别原理框图

2.9 接收机设置接收逻辑回路。当监视信号消失 10ms 内, 如果无跳闸信号到来, 将闭锁跳闸输出, 并给出告警信号。

2.10 设置了完善的监视回路, 当电平异常、通道异常、电源电压异常或消失时能及时给出告警信号, 并闭锁跳闸出口。

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计的产品必须运行在极其恶劣的环境中, 对接口的抗干扰性能有非常严格的要求, 对通信功能又提出了更高的要求, 因此平台的设计思想被用于第三代产品。面向对象的设计是在标准化的软、硬件平台上实现的, 其在就地控制、通信能力, 操作员界面及远方控制功能等方面有了巨大发展。数字信号处理技术、非挥发性存储器、表面安装技术、高速的通信总线、光纤技术等新技术都被应用在硬件平台。

本文所提的新一代故障录波监测系统, 在标准化的软、硬件平台基础上, 采用面向对象的设计思想, 使上面这些设计方法和新技术得到充分的体现和应用。

6 总结

工业 PC 以其丰富的硬件及软件资源, 深入人心的影响力与震撼力, 影响着工业测控系统的发展, 工业 PC 市场以每年不低于二位数的速率快速增长, 被行家看好会当作热门的自动化产品, 尤其在数据采集/控制市场占主导地位, 借助于局域网 (LAN) 可实现更大规模的分布式控制系统。随着这一故障录波监测系统的开发及工控机软、硬件价格的降低, 可以推出系列化故障录波产品, 如仿照集散型控制系统设计方法, 开发出容量更大的故障录波监测系统, 满足更大规模变电站的要求。

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3 结束语

从以上的分析看, 该装置在总体设计和电路方面采用了许多新技术新原理。因而该装置具有很高的安全性和可靠性, 完全能够满足电力系统远方跳闸的需要, 它将为电力系统继电保护和自动装置提供更新的换代产品。

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- 3 Performance and testing of teleprotection Equipment of power System IEC834- 1. 1988
- 4 SSB System ESB 500 for power line Carrier Communication
- 5 SW T 500F6 System With F6 Modulation for Transmission of protection Signals for Direct or indirect Remote Tripping. Siemens AG Documentation File

CONTENTS AND ABSTRACTS (Partial)

THEORETICAL STUDY AND APPLICATION

The Influence of Reclosing Instant to CCT Yuan Yuchun, Zhang Baohui(4)

The critical clearing time (CCT) is defined as a given maximum permissible duration of fault before power system loses its stability. In general, CCT regards fault location, fault type and system structure before and after fault. For a given fault the extent of the CCT is decided on the stable region of the system under the fault. It is indicated from analysis on the transient energy function of the system after reclosing, that the reclosing can decrease the transient energy of the system. If the transient energy is decreased to less than that when not reclosing, the reclosing can improve the system's stability. It is indicated from calculation, for the fault at which the system will lose its stability under the second swing, the reclosing is able to heighten the withstanding capacity of the system to the fault. Comparing with that when not reclosing, the CCT of the fault increases importantly.

Keywords: Reclosing CCT

Node Voltage Analysis Method of Fault on Parallel Double Transmission Lines with Multi-Branches

..... Zhang Xiaoyou, Cao Yijiang(7)

Based on the current measured on each terminal of parallel double transmission lines with multi-branches, calculate the node voltages to detect and diagnose fault on the transmission lines. It is proved from simulation that the method is effective.

Keywords: Multi-branch Parallel double transmission line Fault diagnosis

A Measuring Method of Power System Frequency Based on the Fourier Filtering Principle

..... Zhou Dam in(10)

An algorithm which uses output of the Fourier filter to measure power system frequency is presented. The algorithm adopts a simplified processing mode to eliminate the influence of different amplitude gains of sine and cosine filters and thus decreases calculation and responding time. Simulation result shows that the algorithm doesn't suffer from voltage zero-cross-point and has a higher measuring accuracy.

Keywords: Frequency Frequency measurement Power system

A New Algorithm of Microprocessor-Based Transformer Differential Protection

..... Huang Chun et al(14)

A new algorithm of microprocessor-based transformer differential protection which uses a principle of cross phase angle method is presented. The algorithm can reliably discriminate internal and external faults of transformer and features less internal memory occupied, less calculations and shorter response time to fault.

Keywords: Transformer differential protection Cross phase angle method Microprocessor-based protection

Fast Data Acquisition of Stability Supervisory Control for Power System

..... Ruan Shuhua, Zhou Buxiang(18)

A circuitry design scheme which can fast acquire pre/post fault data to ensure the real-time of stability supervisory control is presented through the analysis on data requirement of stability supervision control of power system and the availability of existing devices.

Key words: Stability supervisory control Data acquisition Realtime

NEW PRODUCT DEVELOPMENT

Development of XWJK-3000 Open Computer-Based Supervision and Control System

..... Cao Quanxi et al(20)

A computer-based supervision & control system with open system structure is introduced. It uses DSP, PC bus and network technique. It can be used to realize integral automation in 35~220kV substations.

The Study of Microprocessor-Based Stability and Control Device Applied in Fengbai System

..... Zhang Tao et al(23)

A new type of microprocessor-based device based on-the-spot is introduced. The device deals with the voltage of busbar and the current of transmission lines which are connected to the device. The device detects type of fault by means of the voltage and current and trips generators according to the settings. The hardware and software of the device are mainly described. Today, the device is applied in Dongfeng substation, Meihe substation, Hadawan substation and Fengman hydropower plant of Fengbai power system.

Analysis on the Technical Features of YTF(S)-500 Remote Trip Signal Transmission Device

..... Zhu Yanzhang, Wang Kuipu(27)

YTF(S)-500 remote trip signal transmission device is a new generation of remote tripping device which is developed basing on the advanced technology of SWT-500F6 teleprotection signal audio transmission device and ESB500 power line carrier of Siemens company. Differing with other remote tripping signal transmission devices in China, the device can simultaneously transmit the remote tripping signals of two independent systems. It has higher safety and reliability than that of other devices, because it adopts the patent techniques of Siemens company, the keyed frequency-shift F6 modulation technique and the pulse noise restraint technique.

Keywords: Remote trip Safety Reliability Keyed frequency-shift

Development of IC- Based Complete Protection Suitable for Small or Middle Scale Hydro (Thermal) Power Stations Zhang Dawei et al(30)

An IC- based protective device which is suitable for the small or middle scale hydro (thermal) power stations with the single generator capacity not more than 50MW and the outgoing voltage not higher than 35kV is introduced. The device uses digital dial setting and its main protective unit is equipped with element failure locking circuit. So it has higher reliability and flexibility.

Keywords: Protection digital setting IC- based Small and middle- scale hydro (thermal) power stations

GENERAL DESCRIPTION

Current State of fault Recorder and Discussion on New Scheme Su Hongxun et al(33)

The main functions and important features of the new generation of combined fault recorder and monitor device which is set up on IPC technique, LAN technique and communication technique are described in view of the shortcomings of fault recorder in China.

Keywords: Fault recorder Harmonic analysis On- line data analysis IPC LAN

Discussion on the Maloperation Cause of HF Blocking Type Protection Zhang Keyuan et al(39)

The influence of 150Hz line- frequency component which comes into the transceiver of HF protection via HF channel is analyzed. Combined with the analysis on the interrupted waves of receiver's HF signal recorded at two faults, the judgement is given that the maloperation results from the 50Hz line- frequency component which comes into the HF output circuit of the transceiver when the HF channel is not grounded well. This paper presents a method of restricting the line- frequency component and suggests to verify the correctness of the analysis by farther simulation combined with site experience.

Keywords: Receiving interrupt HF channel HF transformer saturation Lin- frequency component Ground potential rise

EXPERIENCE EXCHANGE

THR Distance Protection Applied in Dayawan Nuclear Power Station Zhang Huagui(45)

For the connections of 500kV one- and a- half CBs, line protection is equipped according to line layout and operates to two CBs. The available distance protections can be selected from domestic CKJ-1, LZ96 and RA ZFE of ABB company, 7SL32 of Siemens company, TLS of GE company, and THR of Reyrolle company, etc. The THR distance protection used on the Dayawan nuclear power station to Zengcheng 500kV line is introduced.

Keywords: Static type Distance protection Swing blocking

Analysis and Countermeasure of Anomaly in Control Circuit Yu Junfeng et al(49)

The anomaly of control circuit is carefully analyzed in three aspects and the detailed solution is presented basing on some typical examples.

Keywords: Control circuit CB Tripproof relay System reliability

RELIABILITY RESEARCH

Study on the Testing and Assessment Method of Measurement Relay's Reliability Han Tianxing et al(52)

Because the failure of relay and protective device can lead great loss to power system and other industries, to rise the reliability of equipment used in the power system is very necessary. Measurement relay is a basic unit of relay protection for power system, so to study the reliability of measurement relay becomes more important. The reliability data system is set up basing on the operation feature of the relay. Many important questions, such as how to perform the verification, assessment and statistic of the reliability are discussed and the testing procedure is described. Basing on the above test theory of reliability, the reliability tester of measurement relay is studied.

Key words: Measurement relay Reliability data system Reliability test

The Designing of Resisting Disturbance of the Subrack Han Zaolin, Xiao Juan(56)

Along with the development of modern scientific technique, more and more equipment in power, electronic and apparatus industries use subrack structure to lay electronic elements. To decrease the influence of electromagnetic wave and static electricity produced from the equipment and environment on the function of the equipment, how to improve the function and reliability of resisting disturbance in aspects of material selection, earthing design, card screening, mounting location and ventage design are discussed.

Key words: Subrack Anti- interference design Screening