高灵敏度的馈线保护

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火电厂厂用电系统的安全问题,一直是困扰电厂安全运行的一个薄弱环节。

根据电力部电力科学研究院《一九八三至一九八四年全国十万千瓦以上事故统计分析》,1983、1984两年,全国十万千瓦以上发电厂的火力发电厂电气方面的事故为108.5次,其中厂用电系统事故35.5次,占整个电气事故的36.4%,少发电量为17358.9万kW,占整个电气事故的26.5%。

电力部安生技函《94年48号:关于发送(1993年全国高压开关工作总结和事故分析)的通知》,1993年全国开关事故次数为168次,6～10kV开关发生事故107次,占整个事故次数的63.69%,其中绝缘事故65次,占整个事故的38.69%,居各类事故之首。

我省金竹山发电厂自投产以来,6kV高压电源系统共发生事故42次,其中28次发生在6kV厂用配电室内的高压开关柜上,事故原因基本上是出于启动给水泵,误操作,小车开关一次插头容量小或绝缘击穿,电缆头爆炸,电动机故障等;事故损坏基本上都涉及电源开关,并伴随开关柜起火、爆炸,造成开关柜内CT、PT、小车开关及其柜内隔板、柜内二次设备烧毁,并损坏相邻开关柜。据统计,投产以来该厂6kV厂用电系统因开关柜的问题引起的厂用电起火爆炸事故,占25次,共烧坏小车开关,电压互感器74台组,因开关柜事故,厂用高压变局部烧坏2台,报废一台,事故造成少发电量3亿余度,直接经济损失超过100万元。

当然,各类厂用电气设备事故及其发生的原因都不是孤立的,这其间有电缆的绝缘问题,开关柜本身的结构问题等等。但是作为设备的继电保护装置,其整定和配合不当,往往是造成厂用开关的事故甚至扩大事故的重要原因。

例如,金竹山发电厂高压厂用变的过电流保护,按照避开5倍的自启动电流来整定,其定值为6.4kA,而6kV两相短路最小短路电流为9.67kA,

$$\text{则保护的灵敏度 } Km = \frac{9.67}{6.4} = 1.51。$$

仅能满足要求,同样的情况对电动机的过电流保护尤甚,往往造成马达的烧坏。

高灵敏度馈线保护,就是保护装置的整定不需要躲过电动机的启动电流,而使其灵敏度得到极大的提高。

分析不接地系统AC两相在各种两相短路情况下的相位。

当BC两相短路时

$$I_{dc} = -I_{db} \qquad I_{da} \approx 0$$

$$I_{dc} \gg I_{da} \qquad \text{且超前于 } I_{da} \text{ 为 } 90°$$

当CA两相短路时

$$I_{dc} = -I_{da}$$

即 I_{dc} 超前于 I_{da} 为 180°

当 AB 两相短路时

$$I_{db} = -I_{da} \qquad I_{dc} \approx 0$$

$$I_{da} \gg I_{dc} \qquad 且滞后于 I_{dc} 为 90°$$

因此,当仅有 A 相 C 电流互感器接入时可采取将 I_c 相电流超前移动 60°的方法,并取输出为:

$$I_p = I_a + I_{c'}$$

正常运行时, $I_p = I_a + I_{c'} = 0$ 　如图 1 所示:

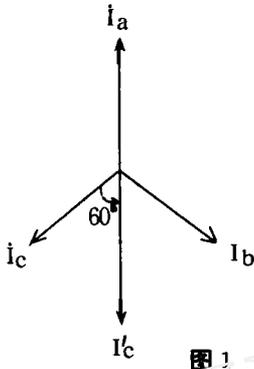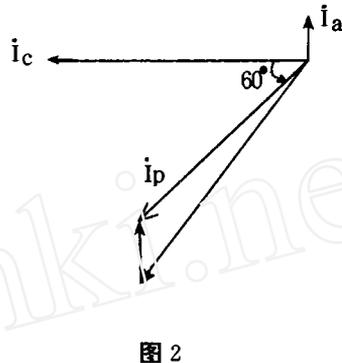
图 1

图 2

在各种短路情况下,其输出 I_p 的向量关系则如图 2、图 3、图 4 所示。

①BC 短路时向量图如图 2;

②AB 短路时向量图如图 3;

③CA 短路时向量图如图 4;

由以上分析可知,采用该接线在发生两相短路时,其输出均为短路电流,即 $I_p \approx I_0$,具有相同的灵敏度。

当一相断线时,则 $I_p = \dot{I}_a + 0 = I_h$,输出为额定负荷电流;故装置的整定值仅仅需要躲过一相断线时的负荷电流。显然其定值可

图 3

图 4

以大大降低。例如在前面提到的金竹山发电厂,其 6kV 厂用的大负荷电流为 1kA 时,若取 1.2 倍可靠系数则当最小短路电流为 9.67kA 时,其灵敏系数可提高到 8。

该装置采用集成电路原理已由长沙继电器厂生产并于 1995 年元月 3 日投入金竹山电厂运行。用户反映,装置性能稳定,动作可靠,使电厂厂用电的安全运行得到了极大的改善。
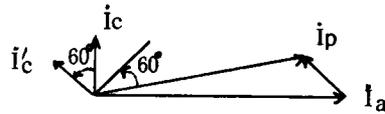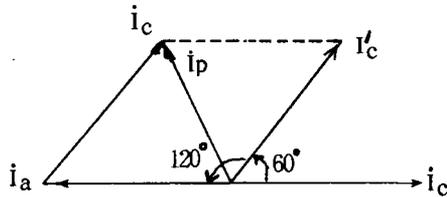
Approach to A Complete Set of Microprocessor—Based Protections for LV or MV Substations ········ **Chen Peilun,et al**(34)

This paper introduces a complete set of microprocessor based protections which are suitable for 6~66kV substations and can realize various relay protective functions of feeder,transformer,capacitor and motor in the substations. The protections feature high uniform hardware,strong anti—interference and capability of communication with PC computer.

Key word:complete set of microprocessor—based protection,hardware,I^2C communication,RS—485 communication port,integrated automation,80C552 SCP

Analysis on Reliability and Security of SWT500F6 Teleprotection Audio Signal Transmission Device ································· **Zhu Yanzhang,et al**(38)

Through analysis on the principle,security and reliability of SWT500F6 teleprotection audio signal transmission device as well as various cases easily occuring in site operation,this paper gives you a new knowledge of SWT500F6 and is very helpful to operational person on site.

Key Word:teleprotection,key frequency shift,priority code,security,reliability

Study of Microprocessor—Based Motor Fault Monitor and Protection ······························ **Hu Chongyue,et al**(41)

This paper presents a new motor fault monitor and protective scheme which is based on the analysis of different phase sequence components of operational current. The monitor and protection device is made up of microprocessor and features stronger function,low cost and higher reliability.

Key Word:motor fault,SCP,monitor and protective device,anti—interference

Development and Approach to Management Information System of Relay Protective Equipment for Power System ································· **Du Jingyuan,et al**(44)

This paper simply describes the principle of E—R method for database design,and then analyzes and studies the relay protective equipment of power system according to the E—R method and the general rule of management information system development. The information system is programmed in FOXPRO2.5 and C language under DOS system. The functions and realization method of the information system as well as its convenient help function are simply introduced. The system features quick operation speed, high code quality, friendly man—machine interface, sensitive operation, rich prompt, and stronger applicability. After slight change,it can be spread to power system or other industrial fields. So it is very valuable to apply and spread.

Key Word:management information system,database,power system,relay protection

High Sensitive Feeder Protection ························ **Wen Cunrun,et al**(48)

A Research for Intelligent Low—Frequency Decrease of Load Device by Using Single—Chip Computer ················ **Sun Ying,et al**(50)

This paper introduces an intelligent Low—frequency decrease of Load device by using single—chip computer. This device can automaticly change the frequency constant and the delay time according to the rate of decreasing frequency. It is favourable to the power system stablity by quickly clearing of the power load.

Keyword:low—frequency,decrease of load,single—chip computer

SERVICE EXPERIENCE

Discussion on Secondary Connections of PTs in 110kV system ························ **Li Changguo**(53)

Questions and Improvement of INDACTIC 65C Fault Recording Device of BBC Company in Service ··················· **Shen Xuebin,et al**(57)

This paper analyzes the questions of INDACTIC 65C fault recording device,such as interface box damaged and input parameter error between data collection station and data analysis station in service of Yuntian and Gangshi 500kV substations. The improvement scheme and considerations to be noted in adjustment are presented.

Key word:data collection station,data analysis station

Improvement of Protective Scheme in Middle and Small Size Electric Power Stations ························ **Yu Weijun**(62)

STANDARDIZATION RESEARCH

Group Technique and Standardization ························ **Li Shaofeng,et al**(71)

This paper presents group technique and standardization concept and further discusses the relationship between group technique and standardization and the promoting action of group technique on design,technology,production and management.

Key word:group technique,standardization