

通用型高精度光纤传感系统*

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【摘要】 本文介绍了一种通用型高精度光纤传感系统并将该系统用于电流的在线监测。

【关键词】 通用型 光纤传感系统 在线检测

前言

光纤传感系统具有高的绝缘性能、抗强电磁干扰、传输损耗小、重量轻、体积小等独特的优点。因此,特别适合于高电压系统、远距离信号传输、强电磁干扰之处进行在线检测。

本文介绍一种通用型高精度光纤传感系统,本系统采用高精度双极型 V/F 变换器作为调制器,由 8098 单片机系统完成信号处理与控制并且可以与各种传感器配合,实现各种物理量、化学量的高精度在线检测或监测。

现以本系统作为测量用电流互感器测量电流幅值与频率为例,介绍系统的具体结构、软硬件设计。

1 现有计量用电流互感器的情况

电力系统用电流互感器有测量和保护用二种。其中,测量用电流互感器主要与测量仪表配合,在电力系统正常工作状态下,安全准确地测量电流,并与电压互感器配合,测量电能、功率因数等等。对测量用电流互感器的主要要求是绝缘性能好、准确度高。

传统的电磁式电流互感器由于磁性材料性能的非线性、磁损耗等原因,影响了准确度的提高,对绝缘的高要求又使其制造工艺要求严格,重量重,体积大。

我们研制了通用型高精度光纤传感系统并将其用于电流幅值与频率的测量。

2 系统硬件设计

2.1 系统硬件框图

本系统硬件框图如图 1 所示。其检测发射部分主要由空心电流互感器、滤波放大电路、V/F 变换器、光纤驱动部分及电源电路组成。接收部分包括接收电路、8098 单片机系统及显示部分。

2.2 检测发射部分的电源电路

为了给检测发射部分提供足够、稳定的电源,保证测量的精度和测量电流的范围,设计中采用铁心互感器从母线电流获取能量的方案。

图 2 为电源电路示意图。铁心互感器二次线圈电流经 I/V 变换、整流、滤波、稳压后作为检测发射部分的电源。

整个电源电路还包括必要的保护环节。

2.3 传感器

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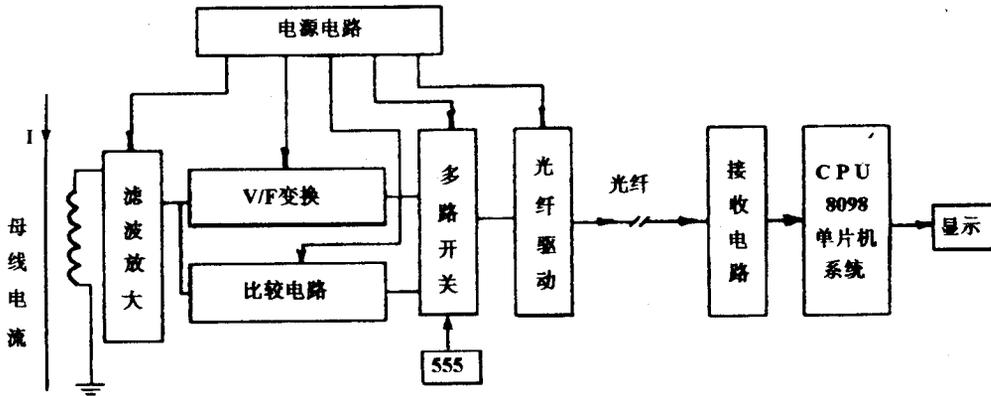


图1 系统硬件框图

电流取样的传感器的精度与线性度对系统测量的精度有一定影响。

空心电流互感器具有测量范围大、线性度好、精度较高、价格低等特点。因此,本设计采用空心电流互感器作为电流取样的传感器。

如果采用霍尔器件型电流传感器是一种很好的方案。目前已有成熟的产品。该类型传感器精度高、线性度好,响应时间快。在大电流测量中具有很好的前景。

2.4 V/F 变换器

本系统采用高精度双极型 V/F 变换器 AD650K。AD650 芯片管脚如图 3 所示。AD650k 的主要特点有:

- (1)工作频率高,最高工作频率达 1MHz
- (2)非线性度与温漂低。当输出频率为 10kHz 时,非线性度的典型值为 0.002%,温漂小于 $\pm 75\text{ppm}/^\circ\text{C}$;
- (3)输入电压范围大,输入方式可以是单极性、双极性。
- (4)输出连续跟踪输入,可对连续变化的电压进行 V/F 变换;
- (5)外围电路简单

在本系统中,AD650 的输入方式为双极性输入,即当输入电压在 $-5\text{V} \sim +5\text{V}$ 之间变化时,输出频率在 $0 \sim f_{\text{max}}$ 之间线性变化。

图 4 为其外部接线图。图中 R_s 用以调节输入电压下限,电阻 R_1 、电容 C_{os} 决定输入频率范围,采用这种方式可节省绝对值电路或峰值取样电路。

2.5 频率测量电路

比较电路是用于测量电流频率,将正弦波转换为频率相同的方波,并通过多路开关与幅值

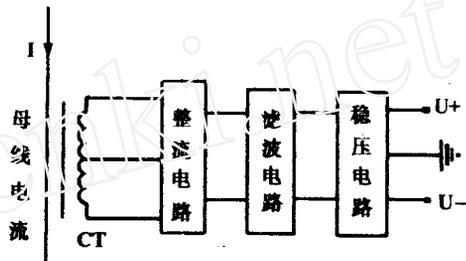


图2 电源电路示意图

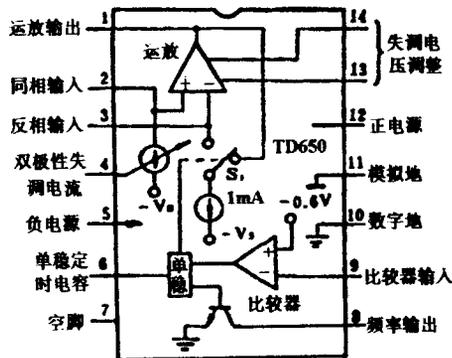


图3 AD650 管脚图

信号分时轮流传送。

定时器 NE555 用于切换多路开关的通道,从而分时选通 V/F 变换后的幅值脉冲信号与比较电路输出的频率信号。

2.6 接收电路

由光电管转换的脉冲信号是很微弱的电流信号,因此要经过 I/V 变换。由于取样电阻较大还须经过阻抗变换。微弱的电压信号尚需进行放大以适应 8098 单片机的要求。此处不再赘述。

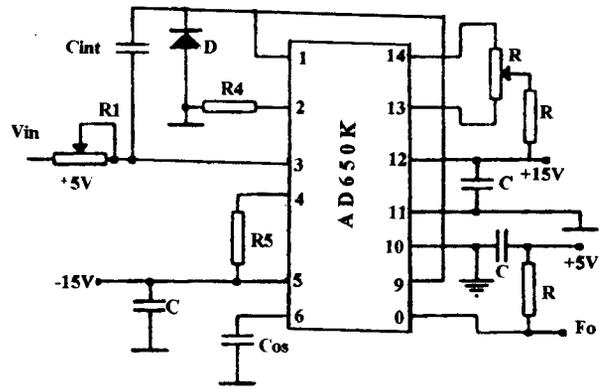


图 4 AD650 外部接线图

3 单片机系统与软件

本系统信号处理与控制部分采用 8098 单片机系统,其由 2764EPROM、8279 显示、键盘电路及相应的软件组成。

8098 的特点是采用准 16 位结构,是高集成度、高性价比、高抗干扰能力为一体的新一代微处理器。

由接收电路传递送来的信号可直接与 8098 高速输入接口,不必经过 A/D 转换。

8098 单片机系统主要完成对电流幅值、电流频率的计算、转换和显示等。因为输入信号是电流幅值和频率的迭加,也必须由程序加以辨别。

图 5 是本系统主程序流程图。

表 1

输入电压(V)	输入频率(kHz)	输入电压(V)	输出频率(kHz)
-5.00	0.035	1.00	26.687
-4.00	4.05	2.00	31.120
-3.00	8.923	3.00	35.569
-2.00	13.354	4.00	40.009
-1.00	17.801	5.00	44.446
0.00	22.224		

表 2

参数值 输入电压	实测频率 (Hz)	实测电压 (V)	实测周期 (Hz)
0.00	4444	0	
0.50	4622	0.505	50.02
1.00	4798	1.005	50.01
1.50	4973	1.497	50.01
2.00	6146	1.994	49.98
2.50	6320	2.489	50.00
3.00	6503	3.009	50.01
3.50	6677	3.503	50.01

This paper simply describes the mathematic model for computer setting calculation of bus differential protection, consideration of operation mode, protection setting principle, and setting calculation program of the bus differential protection written basing on the above method. The program has been applied in a real electric network and can meet the requirement of engineering calculation.

Key words, bus differential protection, computer calculation

Research The Algorithm of Extracting The Square Root in Electric Transducer Zhou Damin(30)

It will take a lot of time to extract the square root in the microprocessor-based electric transducer realized on electrotechnical laws. This paper firstly analyzes the shortcomings of the two algorithms of extracting square root, Newton iteration and fast table look-up, and improve them to yield two adaptive combined algorithms of extracting the square root. Thus the speed of extracting the square root increases greatly.

Key words, electric transducer, algorithm of extracting the square root

NEW PRODUCT DEVELOPMENT

General-Used High Accuracy Optic-Fibre Sensing System Zhang Peiming, et al(35)

This paper introduces a general-used high accuracy optic-fibre sensing system which is suitable for on-line measuring current.

Key words, general-used, optic-fibre sensing system, on-line detection

Developmet of Electromagnetic Relay CAD Expert System Xia Shixin, et al(39)

The architecture, function, building method and feature of the electromagnetic relay CAD expert system are described. The system is equipped with an experience knowledge base of relay expert, which can form judgement and inference upon the expert experience knowledge and simulate the design thinking and solving way of the experts. Application of the expert system technique in CAD solves the non-numerical questions in conventional CAD system and has important significance in realizing intellectualization and automation of electric product.

Key words, electromagnetic relay, CAD expert system

Application of Integration Development Technology in Upgrade of relaying panel CAD system Xu Tao, et al(43)

Research on KGD3 Control Power Supply of Electromagnetic Brake Xie Shuangquan, et al(48)

SERVICE EXPERIENCE

Discussion on Preventing DC Parasitic Circuit And One-Point-Earthing Zou Shenyuan(52)

Some accident examples of parasitic circuits occurring in relay device are listed. The improving method is presented by analyzing these examples and how to use the special-used terminals in The Keyoints of Anti-accident Measure in Relay and Safety Automation Device' is described. This paper also analyzes the relationship between the capacitance of dc postive and negative poles to earth and the voltage of both coil ends and the measures to be taken when the positive terminal of output auxiliary relay coil earthes.

Key words, parasitic circuit, one-point-earthing

Discussion on The Relay Protection And Secondary Circuit in Main Electric Connections of $1 \frac{1}{2}$ Circuit Breaker Used for 220kV Substation Zhang Huaqing(58)

Discussion on Selectable Recording of Fault Recorder in Guangyinge Substation Wang Bing(64)

Application Problem of Economizer Signal Lamp in Control Signal Circuit and Its Solution Chen Yuanpeng(65)

Application of ZRJ-03 Intelligent Thermotechnic Meter Calibration System Wang Dean(67)

STRUCTURE AND TECHNOLOGY

Discussion on Several Questions of CAPP Xia Chuenhou, et al(71)

Significance of Application and Dissemination of SMT Yin Xuebo, et al(74)

This paper explains the significance of application and dissemination of SMT and analyzes the process of SMT and THT. It also describes the feasibility of SMT.

Key words, SMT, SMD, SMC, SMB

Technology and Quality Control During The Trial-Production of Relay Protection Product Prototype Wang Jie(77)

Technology and quality control is closely related with the quality of prototype trial-prduction of relay protection product. In view of the speciality of prototype trial-production and the site management of trial-production, the action of technology and quality control during the trial-production of relay prototype is described.

Key words, prototype trial-production, technology, quality