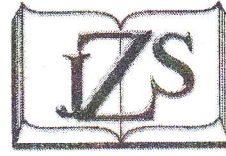


An Investigation of TDM for PAM Signals



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Abstract

An analog information signals were converted to discrete-analog signals by the process of sampling. A naturally sampled signals were modified to a PAM (Pulse Amplitude Modulation) signal by flattening the pulse tops to give rectangular pulses. PAM signals were multiplexed together by interleaving the samples of the tributary information signals. The resulting TDM (Time Division Multiplexing) signal had narrower pulses, and therefore greater bandwidth , than was necessary for each tributary signal alone. This paper discusses the using of EWB package to produce time-division multiplexed PAM signals.

Keywords- Sampling, PAM, TDM .

Introduction:

Digital communication is central to successful information technology operations in both the work place and at home. One of the techniques employed in digital communications is pulse amplitude modulation (PAM). PAM is an amplitude modulated form of pulse carrier , and hence has all the advantages and disadvantages of purely analog AM, a major disadvantage being noise. It is used extensively in telecommunication as an intermediate step of other techniques such as quadrature amplitude modulation (QAM), and pulse code modulation (PCM) which is used in the public switched telephone network (PSTN). PAM is used to produce high-level modulation schemes for data modems and digital radio, also can be time-division multiplexed .The usefulness of PAM is emphasized by the research still going on, such as PAM has proved to be very effective first step in introducing digital communications to telecommunications engineering technology students[1], and on error probabilities for QAM systems[2], and

communication systems with cascaded sequences and PAM/QAM signal sets[3].

Pulse modulation may be an end in itself allowing, for example many separate information carrying signal to share a signal pulses, such pulse interleaving is called time-division multiplexing[4,5] .

The objective of this research is to design and implement the electronic circuits for introducing PAM signals and multiplex it by TDM circuit. EWB package was used to implement the electronic circuits firstly. Then the same circuits were implemented practically in the Electronic Laboratory using locally available components.

Pulse Amplitude Modulation

PAM is a pulse modulation system in which the signal is sampled at regular intervals, and each sample is made proportional to the amplitude of the signal at the instant of sampling[6-8].A range of frequencies (50Hz-to-3.4kHz) was used as an information signal, each frequency was sampled with a frequency

of (6f), where (f) is the information's frequency .

Time-Division Multiplexing

A sampled waveform is "OFF" most of the time, leaving the time between samples available for other purposes. Sample values from several different signals can be interlaced into a single waveform, this is the principle of TDM[9-11]. Its output is a PAM waveform that contains the individual samples periodically interlaced in time for different channel frequencies, a frequency divider or sub-multiplexer can be used to produce a common frequency value between them[12-14].

Three-channel TDM circuit was used to multiplex three PAM signals.

The block diagram of the test system is shown in Fig.(1).

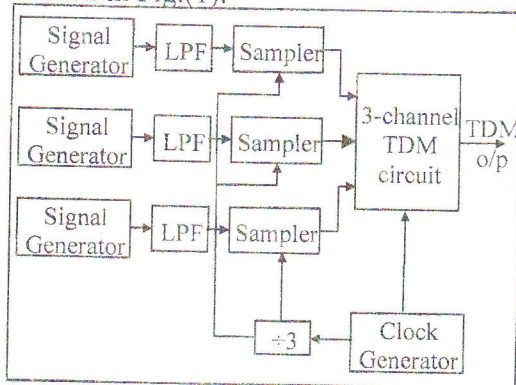


Fig.(1) Block diagram of the test system

The sampler circuit is implemented by using operational amplifiers and FET circuits[15], and a ring counter as a clock divider[16].

Results and Discussions

Two generated PAM signals are shown in Fig.(2) and (3), as it is easy to notice that the frequency of the two signals is (3.6kHz), which is the sampling frequency of (600Hz) information signal. Sinewave

information signal was used in Fig.(2), and square wave information signal in Fig.(3).

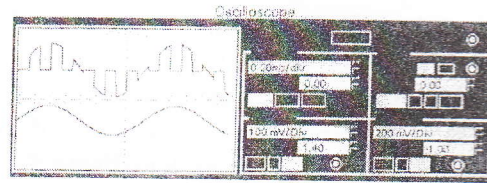


Fig.(2) PAM signal of a sine wave

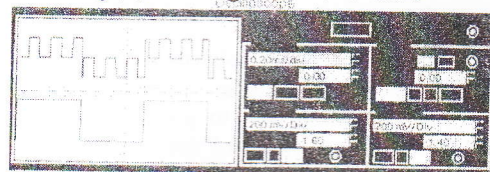


Fig.(3) PAM signal of a square wave

Three signals of each of these PAM signals were time-division multiplexed and the output signals are shown in Fig.(4), (These signals are just examples of the many input signals used during the course of the work).

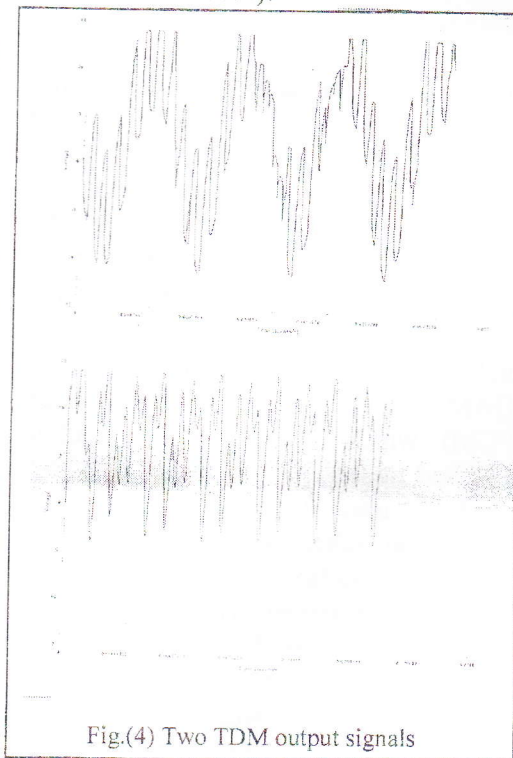


Fig.(4) Two TDM output signals

The TDM output signal shown is with a signaling rate (r) of:

$$r = Mf_s = 3 \times 3.6 = 10.8 \text{ kHz}$$

And the TDM circuit output on the oscilloscope is shown in the photograph in Fig.(5) .

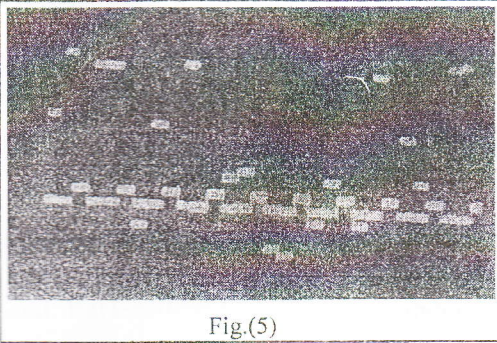


Fig.(5)

The circuit photograph is shown in Fig.(6) .



Fig.(6)

The results using EWB package and practically in the Lab. are the same, there is no difference can be noticed between them .

Conclusions

EWB has proved to be too efficient tool to simulate sampling process and time-division multiplexing for PAM signals.

The circuit built can be used to generate PAM signal for information in speech frequencies range (50 to 3400 Hz), and the TDM circuit can be expanded for more than three channels.

For different channel frequencies, a frequency divider or multiplexer can be used to produce a common sampling frequency value between them .

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لیکۆلینە و وێهێک سەبارەت بە گۆڕینی TDM بۆ سیگنالی PAM

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بەشی ئەندازیاری کارەبا / کۆلیژی ئەندازیاری زانکۆی سەلاحە دین / هەرێمی کوردستان _ عێراق

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پوختە

لەم توێژینە و وێهێکدا سیگنالی زانیاری بەردەوام گراوه بۆ سیگنالی پچرپچر _ بەردەوام بە کرداری پارچە وەرگرتن - سیگنال پارچە کراوی سروشتی چاک کراوه بۆ سیگنالی (PAM) بەهۆی راست کردنی توپکی پرتەکان لاکێشی بەرەم بەینیت سیگنالی (PAM) لێک دراوان بە هۆی تێک ئاختنی پارچەکانی سیگنالی زانیاری تریبیوتەری . لە ئەجامدا سیگنالی (TDM) پرتەئەسک ترو پانی گورزەئەگورزەتری هەیه . کە بۆ هەر سیگنالیکی تریبیوتەری پێویستە . هەموو سورە ئەلکترونیەکان نەخشەیان بۆ کێشراوه و لە تاقیگە جۆ بەجۆ کراون . وە پرۆگرامی (EWB) بە کارهێنراوه بۆ جۆبەجۆ کردنی سورە نەخشە کێشراوهکان.

دراسة تعدد التقسيم الزمني (TDM) للإشارات مضمنة تضمين سعوي نبضي (PAM)

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الخلاصة

فی هذه الدراسة تم تحويل اشارات معلوماتية كمية (تناظرية) غير متقطعة الى اشارات كمية - متقطعة باستخدام عملية أخذ العينات والتي بواسطتها تتحول الاشارات المتصلة الى اشارات مضمنة تضمين سعوي نبضي (PAM) . وهذه الاشارات المضمنة جمعت معا " بالتبادل ، وكنتيجه حصلنا على اشارة (TDM) ذات النبضات الضيقة ويعرض حزمة أكبر من عرض الحزمة لكل اشارة (PAM) على انفراد . كافة الدوائر الالكترونية المستخدمة صممت ونفذت بواسطة برنامج (EWB) ثم في المختبر .