iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** VIII **Month of publication:** August 2017

DOI: http://doi.org/10.22214/ijraset.2017.8285

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue VIII, August 2017- Available at www.ijraset.com

Application of VLSI Technology in Wireless Mobile Communications

Abhinav Boddupalli[1]
[1,] IVth year, B.TECH, EE, Maulana Azad National Institute of Technology

Abstract: Communication is a widely recognized phenomenon and its applications and techniques have been proliferating from its early stages. Among these, mobile wireless communication systems provide users the opportunity to travel freely with in the service area. These systems are made possible by using radio waves as transmission/receiving medium. This paper presents the survey of developments and trends in VLSI architecture and also discusses signal processing algorithms for wireless mobile communications. With ever increasing data being transferred, there is increase in demand for VLSI design and implementation methods for new architectures, design methods, algorithms etc. for high performance and low power in the communication systems.
Keywords: VLSI, DSP, LMS, mobile communications, signal processing algorithms and methods, analog systems.

I. INTRODUCTION

The communication systems that exist today, we can divide them into two groups, those that use as a transmission medium a coaxial cable, copper cable or fiber optic, and those that use as a medium of transmission the air, where each one of them has advantages and disadvantages, with respect to the bandwidth, losses per kilometer, speed of transmission, etc.

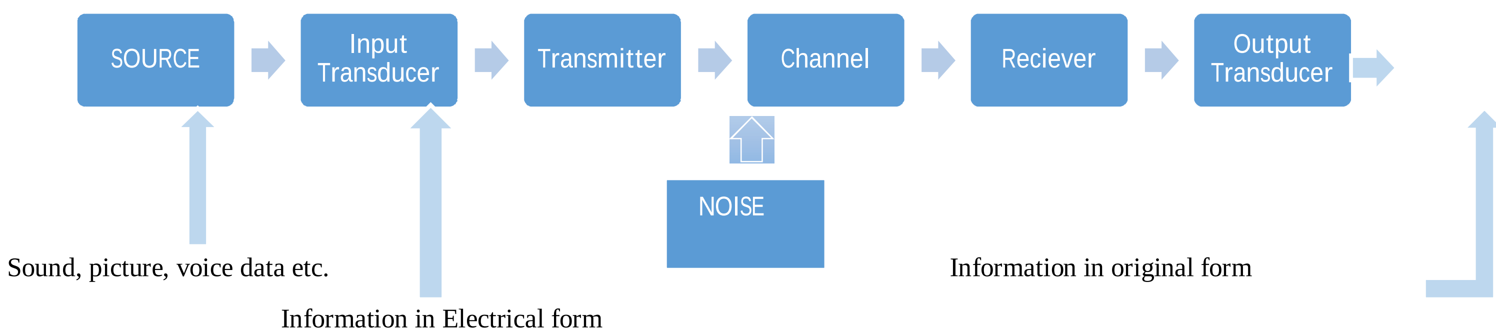

Fig.1.Communication system block diagram

If we are specific to the communication systems that have as a means of transmission the air, i.e. RF systems, we can say that nowadays, have a breakthrough, every day are born new applications of wireless devices, and is even expected to, in the near future, the use of satellites can be eliminated to bounce signals (Gibson, 2012; Hong et al., 2008) and instead the ionosphere is used. An example of this is a research project being carried out by the NIAT (National Institute of Aerospace Technique) in which it is intended the transmission of signals using as communication channel of the ionosphere.
In developing countries, there is a great interest in having communication in all the national territory, there is the project where Internet access is expected in all communities with a population above a certain number. We also want to achieve the link between all medical services; and above all, we want to have a digital government, in which the main objectives are efficiency, that is, greater coverage at lower costs in governmental tasks and transparent among other things, all of this making use of information technologies (Zeng et al., 2009). All these projects lead to a very promising social goal, however, they would be even more praiseworthy if the information technologies with which it is intended to solve and follow these projects were developed locally and we did not have to be forced to Import technology.

II. WIRELESS MOBILE COMMUNICATIONS

There is a wide variety of wireless communication systems for video and data voice transmission in local or global areas. There are wireless point-to-point networks, wireless local area networks (WLANs), blue tooth, multi-directional cellular systems, and satellite communication systems, among others. Wireless technologies that provide mobile voice and data communication services, for example, cellular telephony, Personal Digital Assistant (PDAs), Internet terminals, among others. These wireless networks provide the user the added benefit of mobility in the local area or the wider area, which further depends on the nature of the wireless network. The number of wireless mobile devices has increased globally, users rely on them to connect to corporate networks to access databases, exchange messages, transfer files, and even participate in a meeting with remote access, can be Via Wi-Fi, WLAN or Blue Tooth (Garg, 2010).

The mobile radio communications in the early stages tend to be one way and the alteration from one way to two way radio came into existence only due to the push forwarded by World Wars I and II. From 1980 onwards, it entered the cellular age where three generations can be distinguished: the first generation 1G motive of the present course, conformed by analogical systems including the AMPS used in our environment; The second generation 2G consisting of digital systems: DAMPS, GSM, CDMA, PDC with average speeds of 9,600 bps; Generation 2.5 with GPRS, CDMA rev B with 64Kb / s speeds and finally the third generation 3G with systems operating with WCDMA and CDAM200 technologies, with current speeds of 144Kb / sec. The projection is to reach 2Mb / sec. On the horizon are 4G systems, which will offer high speed data transmission from 2Mb / sec to 156Mb / sec, this generation will fully support the IP (Garg, 2010). This high speed will be due to advances in signal processors (DSP), new modulation techniques and intelligent antennas that will focus directly on the user. OFDM (orthogonal frequency division multiplexing) is a scheme that can be adapted for this purpose.

III. DIGITAL SIGNAL PROCESSORS (DSP)

Due to the new wireless communications protocols mounted on the DSPs, it is possible to have wireless communication over long distances or high speed. A DSP has an optimized architecture for the fast operational speeds in Digital signal processing. It can also process data in real time leaving room for applications with that cannot bear delays. DSPs can be used to manipulate the information and convert it to analog outputs like use video, voice, audio, temperature or position signals that have been digitized and mathematically manipulate them. Typical applications of DSP's include modems, echo cancellation, digital filtering, modulation, video and image enhancement, CD and DVD, speech and compression for increased storage space, speech synthesis and speech recognition. Modern DSP systems are suitable for implementation under VLSI (Very Large Scale Integration).

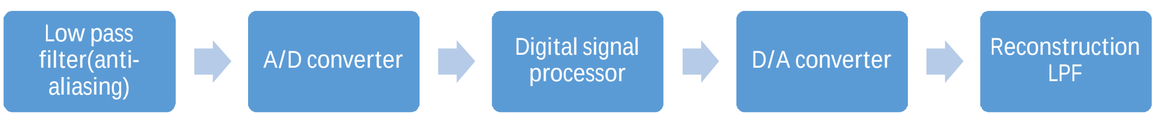

Fig.2.Digitial signal processing system block diagram

VLSI developments are militating the digital signal processing design process by offering more powerful processing elements. Some good examples are the single chip DSP and the systolic array. The large investments required to design a new integrated circuit can only be justified when the number of circuits to manufacture is large, or when the necessary levels of performance are so high that they cannot be achieved with existing technology (Elliott, 2013). Often both arguments are valid, particularly in communications and applications directed at consumers.

The importance of analog multipliers in signal processing, in this case in analog form, using VLSI technology. The direct application of these circuits in this project is the normalized LMS algorithm, for the signal processing for mobile communications. To carry out this research, three structures with current and trans-conductance mode design techniques are proposed. The problems that will be addressed will be to improve the characteristics of each of the multipliers, in addition to the coupling of the multiplier circuit with the algorithm. The development of research is mainly based on the design of three multiplier architectures that are designed in current and trans-conductance mode with features that help to improve the quality of the transmitted signal (Elliott, 2013). The problems addressed were to improve the operation of each of them for implementation in both programming and electronic circuit. They were designed and evaluated in terms of their distortion, bandwidth, power consumption and dynamic range, in order to establish the criteria for their use in signal processing systems where the multiplier is a widely used block, as in Adaptive filters, neural networks and RF circuits.

This has been due to the advances in VLSI design technologies that have made possible the development of analogue adaptive filter structures, which have the ability to handle components to be applied at very high frequencies, implying higher convergence rates and much lower energy than their digital counterparts (Gibson, 2012; Hong et al., 2008). These factors make analogue adaptive filters an attractive alternative to digital adaptive filters in practical applications, such as the equalization of terrestrial mobile communication channels, where low power consumption is required, small sizes of electronic circuits and fast convergence rates (Gómez-Pau et al., 2014). Analog adaptive filters, however, present several problems, due mainly to the limitations of the embodiments of some VLSI circuits, such as analog integration circuits, which can significantly degrade the overall performance of the systems.

Most of the analog adaptive filters proposed in the literature use the continuous-time version of the Least Mean Square (LMS) algorithm with a constant convergence factor to update the coefficient vector of the filter (Hussain & Kumar, 2015; Meher & Park, 2014). However, this can be kept small enough to avoid degradation of convergence due to fluctuations in the power of the input signal. An attractive solution to solve this problem is the use of the normalized version of the LMS algorithm in continuous time (Gibson, 2012), whose discrete-time version has proved to be useful for handling the fluctuations of the power of the input signal (Thomas, 2016).

A modified normalized LMS algorithm is proposed, in which the updating of the coefficients is carried out using a low pass section of first order, with positive feedback, thus avoiding the distortion in the low frequency region due to the imperfection of the integration (Hussain & Kumar, 2015). Standardized step size is used to avoid distortions due to fluctuations in input signal power, resulting in an easier implementation than that proposed (Shibata et al., 2015). The computer simulations show that the proposed adaptive filter structure gives a better convergence behavior than other continuous-time adaptive LMS filter algorithms that have been presented previously, and similar behavior as proposed in (Shibata et al., 2015), with requirements of much smaller hardware.

IV. CURRENT MODE TECHNIQUE

The current mode technique in signal processing in integrated circuits has shown many advantages over the voltage mode which includes an increase in bandwidth, high dynamic range and a better ability to operate with low power voltages. Processing in current mode often leads to simple circuitry and low power consumption (Popa, 2014). Traditionally, however, many analog signal processing has used the voltage as the variable signal. To maintain compatibility with voltage circuit processing, it is often necessary to convert the input and output signals from a Signal Processor in Current Mode (SPCM) to voltages.

Either the transducer, the trans-resistor or both, can be eliminated in these applications where the appropriate variable is in the form of current. When present, however, the transducer is a crucial part of the design since it can limit linearity, frequency response and noise response in the system. Therefore, any transducer intended for use as a PBMC must follow the following criteria (Kinget & Steyaert, 2013)

A. High linearity for large input signals
B. Low noise
C. Non-dominant internal poles
D. Great trans-conductance
E. Low power dissipation

It can also be an important requirement in applications that require a precise value of gm (filters) independent of the process and temperature variations.

V. CONCLUSION

In conclusion, VLSI and signal processing techniques implementation in wireless mobile communications looks very promising such as, for next generation mobile communication, analog components are pushed towards the front-end antenna. Digital transceiver is overwriting the tasks of main signal processing. Performance for WLAN networks can be optimized through VLSI data compression. Therefore, VLSI along with signal processing plays an important role in the mix of next generation wireless communications. However, there are still challenges in some areas such as modelling, architectures and algorithms. Some challenges include issues in simulation or processing of large systems to the level of details. Also, from VLSI perspective, large number of ASIC or SoC gates are difficult to simulate and model for processing large data samples. Although there exists some obstacles, techniques and the continuing research in these areas will likely to make big effect on wireless communication. The wireless technologies are omnipresent and there is high scope that these technologies will be more in the market according to IEEE 802.11(set of MAC and PHY layer specifications).

REFERENCES

[1] Elliott, D.F., 2013. Handbook of digital signal processing: engineering applications. Academic Press.
[2] Garg, V., 2010. Wireless communications & networking. Morgan Kaufmann.
[3] Wakefield,T., McNally.D., Bowler.D., Mayne.A.,2007. Introduction to mobile communications. Auerbach Publications

[4] Gibson, J.D. ed., 2012. Mobile communications handbook. CRC Press.
[5] Gómez-Pau, A., Banerjee, S. and Chatterjee, A., 2014, July. Real-time transient error and induced noise cancellation in linear analog filters using learning-assisted adaptive analog checksums. In On-Line Testing Symposium (IOLTS), 2014 IEEE 20th International (pp. 25-30). IEEE.
[6] N.V.S.V.Vijay kumar, P.Raju, B. SuriBabu Naick, K. Pradeep Vinaik, Venkata Krishna Kumar V.,IJERA journal on Amalgamation of VLSI & Signal processing Technologies for the Implementation and Enhancement in Wireless Communication, Vol.1, Issue-2, pp.310-316.
[7] Hong, S., Yi, J. and Stark, W.E., 2008, October. VLSI design and implementation of low-complexity adaptive turbo-code encoder and decoder for wireless mobile communication applications. In Signal Processing Systems, SIPS 2008. 2008 IEEE Workshop on (pp. 233-242). IEEE.
[8] Hussain, U. and Kumar, S., 2015. Adaptive Echo Canceller Using LMS algorithm. Development, 2(8).
[9] Kinget, P. and Steyaert, M., 2013. Analog VLSI integration of massive parallel signal processing systems (Vol. 384). Springer Science & Business Media.
[10] Meher, P.K. and Park, S.Y., 2014. Area-delay-power efficient fixed-point LMS adaptive filter with low adaptation-delay. IEEE Transactions on Very Large Scale Integration (VLSI) Systems, 22(2), pp.362-371.
[11] Popa, C., 2014. Improved accuracy current-mode multiplier circuits with applications in analog signal processing. IEEE transactions on very large scale integration (VLSI) systems, 22(2), pp.443-447.
[12] Shibata, N., Ohtomo, Y., Nishisaka, M. and Sato, Y., 2015. An STM-16 Frame Termination VLSI With 2.5-Gb/s/Pin Input/Output Buffers: High-Speed and Low-Power Multi-CMOS/SIMOX Techniques. IEEE Transactions on Very Large Scale Integration (VLSI) Systems, 23(6), pp.1089-1102.
[13] Thomas, L., 2016. Power Integrity Analysis For Jitter Characterization (Doctoral dissertation).
[14] Zeng, M., Annamalai, A. and Bhargava, V.K., 2009. Recent advances in cellular wireless communications. IEEE Communications Magazine, 37(9), pp.128-138

.