"DESIGN AND IMPLEMENTATION OF ANALOG ALL PASS FILTERS"

Rasna[1], Dr. Mandeep Sandhu[2]

[1] P.G. Scholar, [2]Assistant Professor
[1]Electronics and Communication Engineering,
[1]Rayat and Bahra University, Mohali ,India

Abstract—The thesis focuses mainly on well efficient model of high frequency range, low power and high stability all pass filters. In vision of the modern communications there is a progressive development in the signal transmission techniques in sight of the contemporary methods arise to transference the signal from source to destination by means of the transmitters and receivers, as the par expansion of these systems is more, transreciever has to be replaced both and in designing such complex model a number of suitable considerations are come into account like filtering the signal and passing the signal form Hz to several GHz mainly for the RF, military application and also for wireless communications. To accomplish the task for building an effective such a novel design is required for the processing and passing the sustainable measured quantity without any loss of the information and its characteristics are to be analysed for the accuracy and efficiency.

In context of these a physical variable is needed for such type of realizations, and from these aspects an all pass filter design here provides all the features like gain, stability and phase, The implementation of the all pass filters is worked out with different methodologies and the selection of the topology for the high range frequencies are somewhat critical to validate. The models proposed accompanies the ideal characteristics of Analog all pass filter such as unity gain, high bandwidth and 180° phase shift over the band of frequencies with supressed noise and high efficiency.

*Keywords***:-** All pass filter, Current conceiver, Analog, Current transistor.

1.   INTRODUCTION

At present in the trends of technology, in the context of signal transference Analog signal processing plays a crucial role in the communication for the signal processing. The possibility for choosing a physical variable, such that it effects mainly and each signal with a dense time and amplitude for the continuous processing cells. In the design of filter configuration in the past many topologies are mentioned to state the behaviour of the signal in the context of signal carrier.by taking all the stated models of all type of the filters an all pass filter is designed and implemented by taking all the feasible characteristics of a transistor with more efficient transmission. In this thesis the design of all pass filter design carries a different terminologies like compound transistor, Tran's linear loops and differential par combinations to perform the all desirable characteristics of a filter using an electronic precise function.

To estimate the behaviour of the filter mainly a transfer function is defined to form a well efficient model for the implementations. In the VLSI mainly a model proceeds with the features like low power low area with high efficiency but in analysing such precise factors the complex function is to derived and solved, here the filter is well implanted by taking account the filter function and realising it with necessary modifications and from the modified function the order and representation is made in all aspects. As the technology is advanced many filters are concluded with the advance tools with specific algorithms in these algorithms clearly mentions the function and the behaviour and comprises many analytical calculations and furthers refers a feedback to modify our design and move with the higher orders.

In an Analog signal processing first order electronic function has a wide range applications and signal generation in a network that is classified in the section of "filters". The term all pass filter evolves from the filter phenomenon where it is called as phase shifter and amplitude preserving feature which has its "former name" and the latter name called as frequency-dependent phase shifter. These two features combined together and gives a powerful electronic function which has extensive applications that ranges from the simple phase equalizer otherwise referred as phase shifter to more complex ones with signal generation of quadrature and multiphase outputs by this higher order filter functions are realized by the simple electronic function.

FILTERS:-

Filters are main necessary blocks in the communications for several applications for filtering and the removing the unwanted bands in the transferred signal and processed signal and the main role of the filter is to extracting the specified band of frequency and filter it in respect to noise and other primary specifications. In comparison to Analog filters with the digital filters the Analog filters adds some features in regard of frequency phase and gain, but in the design of the Analog filters the main perception is the topology selection and implementation with low supply voltage and low area, whereas in the Digital filters the chance of occurrence of the noise is less. So the design of the filters needs all the factors to withstand all the characteristics that affect the behaviour of the signal and the Filters function is to eliminate the random noise.

A. Digital -Filters: In the concern of digital filers it holds mainly ADCs (Analog-Digital Converts) with programming software that is embedded in the microprocessors .Here the main lag will be following by the time constraints due to clock timings in the system and at peculiar points the power may increases due to delays. In view of some high performance devices mainly in FPGA and DSP processor kits a parallel architecture is made for filtering the input summations, but these are quite complex for the digital filters .so digital filters are to be specified with a clear cut in the timing constrains in which the clock cycle need to operate in the precisely and the transference of the signal to next proceeding stage, in this a signal is filtered by the anti-aliasing filter to remove the glitches to the output.

B. Analog filters: Analog filters are mainly operated with the frequency with the continuous amplitude and the time taken for the signal to proceed to the output .In the Analog circuits the AC response depends on the feeding supply and the crucial biasing conditions, as the input voltages with the determined frequency prepends the noise to the circuits, in concern to the high range, the frequency variations will be par greater and to overcome this the port should withstand high stability. Mainly these filters tenders gain to the system and phase alternations.

TYPES OF FILTERS:

Filters are broadly classified in two types depending upon the distinct behaviour with input they are
1) Component based 2) Frequency Based

(i).Component based:

on the component based they possess mainly active filters and passive filters utmost in which active filters pursues the resistors and capacitors, For the low frequency these components are placed in the filter design which holds attenuations that corresponds to the output in the passive filters are represented with the RC(ResistorCapacitor)networks and LC(Inductor-Capacitor)networks.

(ii)Frequency Based:

In respect to the frequency in the bands the filters that catches the respective bands are low pass (LP) filters that passes only low pass frequency and high pass (HP) to pass only the high frequencies for amplifiers and receivers. For particular applications in the transmitters the band pass (BP) to allow only respective bands and the band stop (BS) to supress the particular band of the signal. the frequency based filters are shown. In the frequency based filters the output is totally relay on the input with supply voltages, to construct these types of filters an express type of valuations are to be concerned with the desired frequency, gain and the phase change with proceeding to the input ,to accompany this we need to consider mainly with the bands in the frequency like transition band like to allow the particular band of the frequency for transition stop band to stop the particular bands and pass band to allow the band of frequencies.
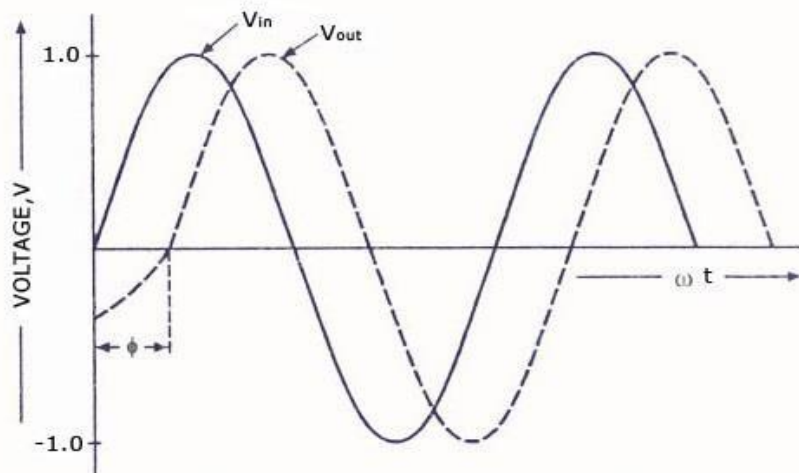
WHY ALL PASS FILTER:

All-pass filters, otherwise called as the phase shifters are used in the processing block of the Analog signal operations, and in this all- pass filters are being a special cases for the filter transfer functions (TFs) Here it offers many advantages for the Analog filter designs. All-pass filters mentions a special case to cancel the unwanted sideband. Zero and pole of the first-order all-pass filter are symmetrically located in relative to the imaginary axis, and real axis due to this location, and the transmission coefficient is seen constant with respect to all the frequencies, and its phase shows with the frequency selectivity which has more usage . Multiple topologies of the All-pass filter are described so far to reach the noted considerations, and In that view various circuits are proposed and implemented, here the circuit carries CMOS transistors that use as the basic building blocks and plus-type second-generation current conveyors (CCII+s) composed of CMOS transistors because of low power. Considering many advantages All-pass filters are used as synthesize multiphase oscillators in the higher order filters which give wider bandwidth. In recent trends All-pass filters has many applications in the field of Radio-Engineering, defence, and wireless communications.

ALL PASS FILTER DESCRIPTION:
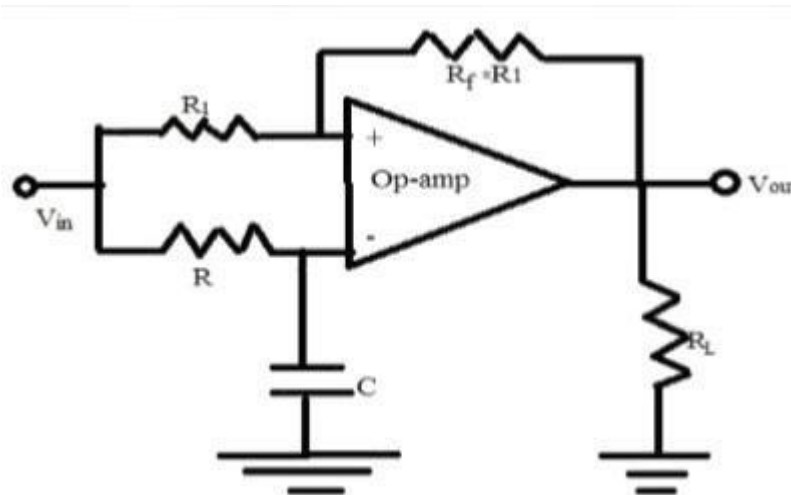
Fig 1. All Pass Filter schematic with op-amp

All pass filter is termed as signal processing filter in which it passes all the frequencies which are given at input and these frequencies are passed equally with gain and changes the phase relationship among various frequencies, here it operates by varying the phase shift as a function of input frequency, where the phase shift crosses 90° in which the input and output signals go into quadrature I.e. quarter wavelengths delay between these signals. These are generally used for compensating other undesired phase shift that occur in system, and it is mixed with an upshifted version signal of original signal for implementation of notch comb filter.

Output Response of the circuit:

All-pass the name itself defines that whatever the input frequency given to the system it allows all the allowable frequencies through it without distortions, at the output of the circuit is observed with respect to the input of the circuit with respect to the amplitude and time.

Fig 2 All Pass Filter output Response

Implementation:

The circuit is to be implemented in the Cadence virtuoso software, with the specified W/L ratios of the transistor. Depending upon the technology the circuit parameters are changed, circuit is to be simulated by choosing the input and output variables and the transient analysis and dc analysis is to be simulated by taking the supply voltage and bias current to the circuit we get the output with the respective input parameters.

PARAMETER	180nm	90nm
Supply voltage	1.8v	1v
Input frequency	0-1Ghz	0-10Ghz
Amplitude	100mv	100mv
Biasing voltages and current	Can't be defined	Can't be defined

The inputs are given according to the table 1 shown above

Analog realization with respect to the z-domain:

All-pass refers to unity-gain across all frequencies where the output is taken with constant amplitude with phase shift

For unity gain:

Gain changes slowly from ⟶ inverting configuration {180° deg}

Non-inverting configuration {0° deg} ⟶

Transition between the inverting and Non-inverting given by the corner frequency fc

$fc = \dfrac{1}{2\pi RC}$

For an all-pass section:

Frequency	Configuration	Phase	Delay in wave	Operation/output
$f \ll f_c$	Inverting	$-180°$	Half cycle	c-opens and inverting path
$f = f_c$	-	$-90°$	Quarter cycle	c-shorts signal pass through in +ve path
$f \gg f_c$	Non-inverting	0 deg	None	c-shorts non inverting path

ANALOG IMPLEMENTATION:

From the Z-domain realization we get the design specifications of the all-pass filters where it has the properties derived from the z-plane, and to implement this in the Analog, a rich catalogue is required to provide all the parameters for the design. Then we proceed with the topologies required and the study relates with the review of an important Analog electronic function, in form of an all-pass filter's realization using current conveyor types and these are implementations can be realized using CADENCE 180nm and 90nm process technology and the 90nm technology for output results and simulations.

➢   **CURRENT CONEYORS:**

In the concern of many high frequency range applications the current conveyor assists the fundamental blocks for processing the signal carriers and introduced in the year 1968 by Sedra and Smith. There is a more discussion in recent years, on current-mode circuits which play crucial role in Current-conveyors. Current conveyors has vast applications range from multifunction and universal filters, oscillators etc. Current conveyors gives a larger bandwidth and more suitable for low voltage applications. The current conveyors cannot use Op-Amps, because, the Operational amplifier has a poor performance when it is need with a current output. There is no feedback in the current conveyor, so it gives a high frequency behavior when we compare to an Op-amp, because the gain bandwidth product limitation is not suitable for high frequency Op-amp.

The Current conveyor has a very simple architecture with wide bandwidth and is capable to operate in low voltages. We have three generation types of current conveyor's are there, but we select second generation conveyor which meets our design specifications.

❖   First Generation Current conveyor, CCI.
❖   Second Generation Current conveyor, CCII.
❖   Third Generation Current conveyor, CCIII.
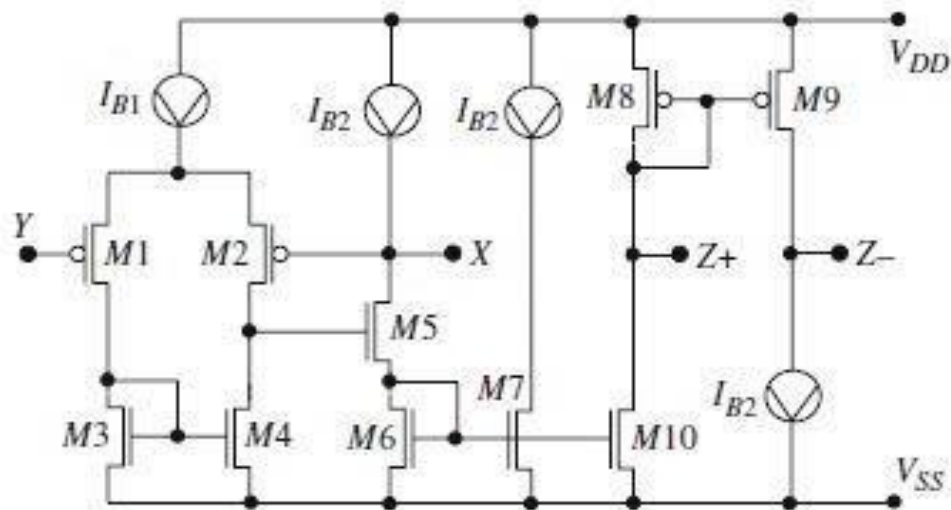
Fig 3 Representation of the CCII (+) circuit

The above schematic represents the second generation current conveyor with positive and negative types and it is combination of the compound transistor and the Trans linear loops, the schematic is made into the block as shown in the above section and the inputs are applied.
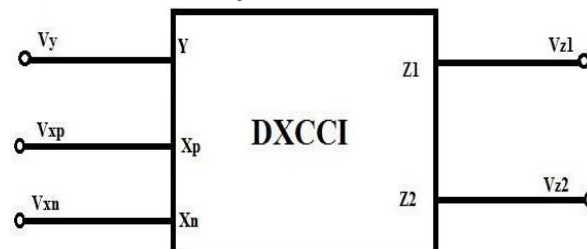
Dual-X-Second Generation Current conveyor:

Fig 4 Block representation of Dual-x- second generation current conveyor
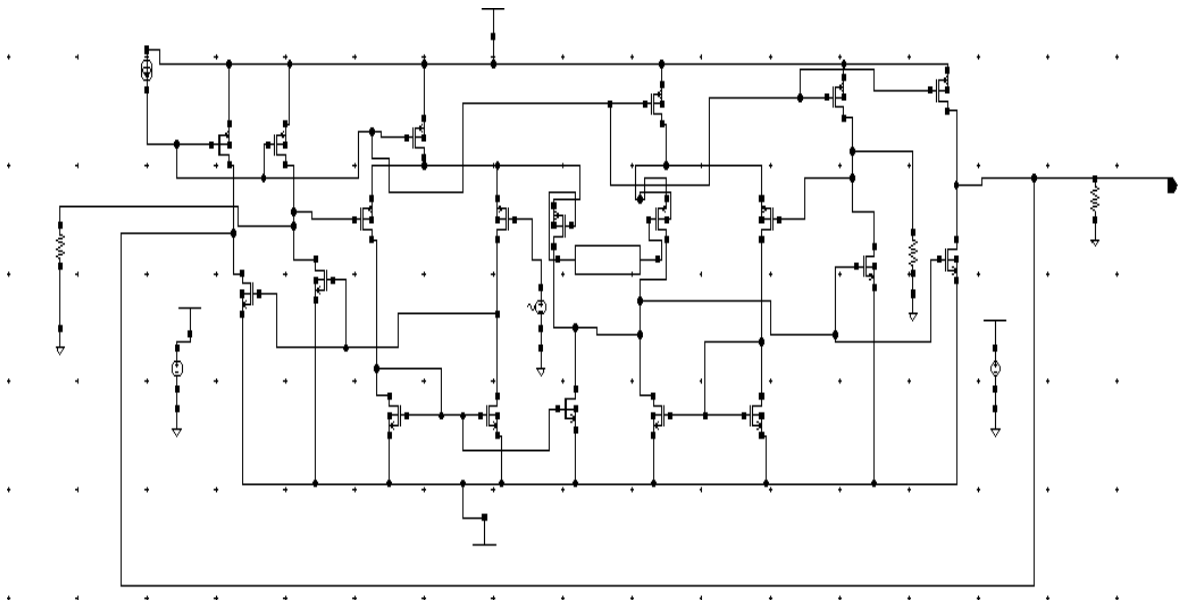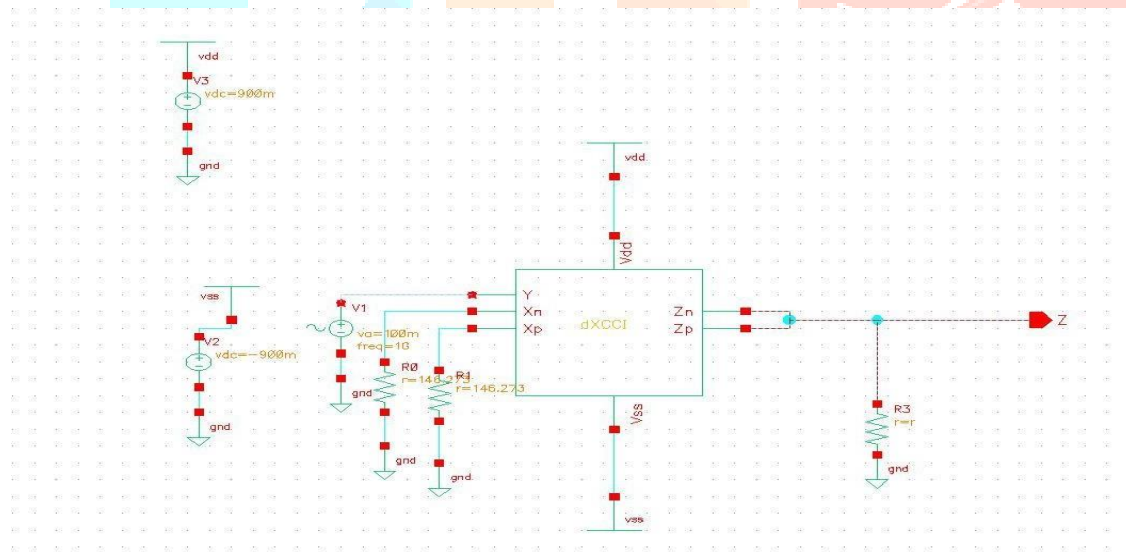
DXCCI Schematics View:
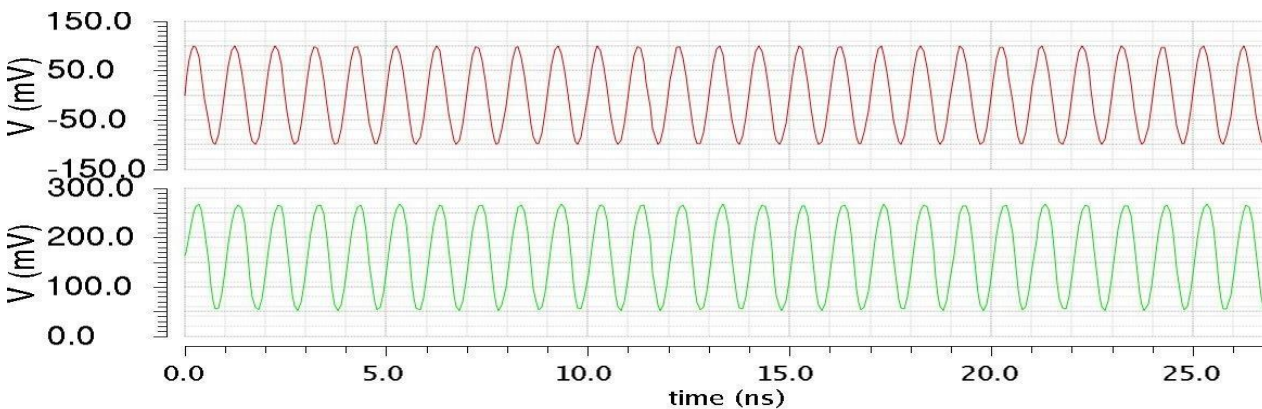

Fig 5 D-X-CCI Schematic

In the DOCCI at the inputs are given as

➤ Input supply voltage,500mv for V$_{dd}$ and -500mv for V$_{SS}$

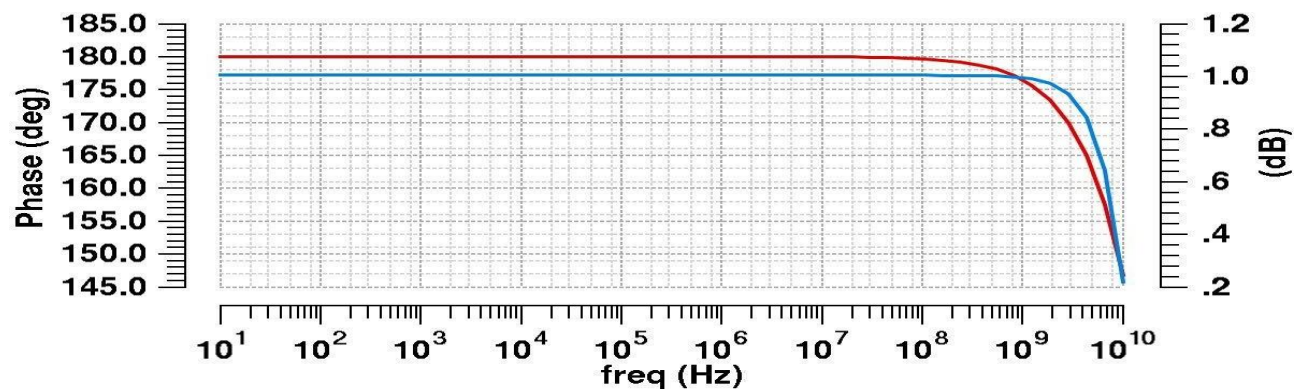➤ Input Frequency 1Ghz

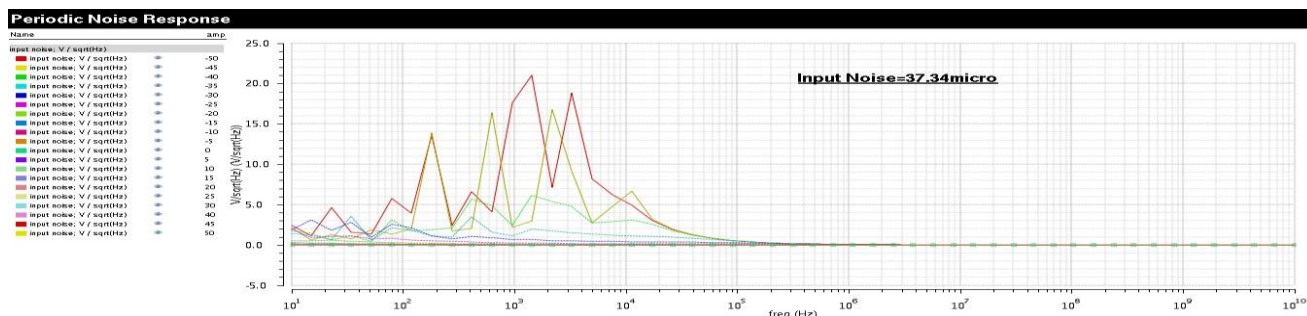➤ Ac magnitude=100mvAC amplitude=100mv

DXCCI Block:

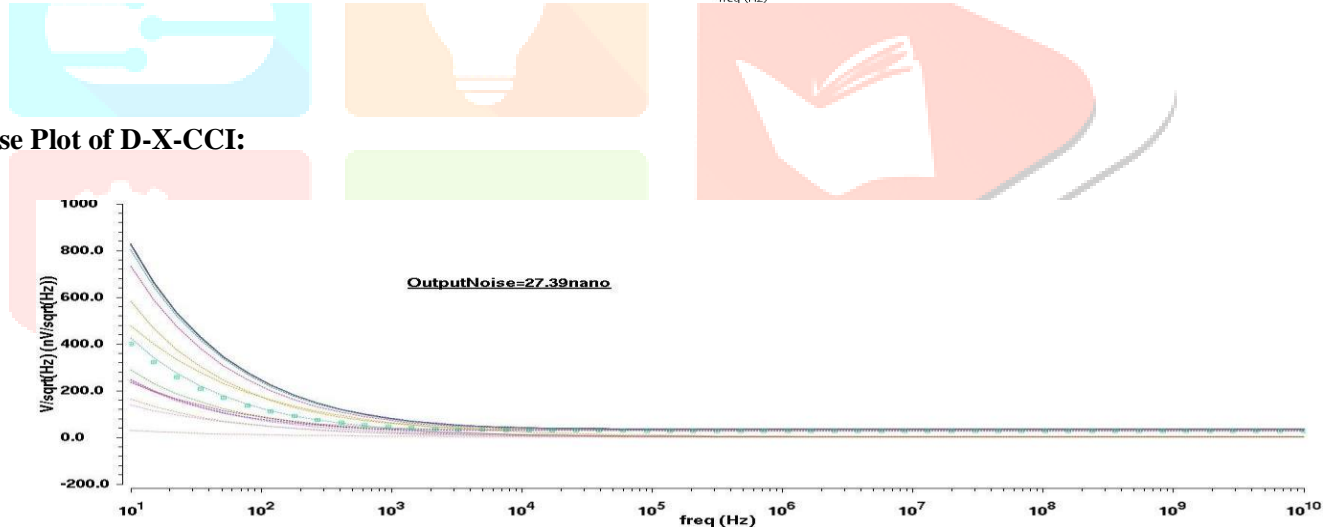**Transient Response of Proposed DXCCI:**

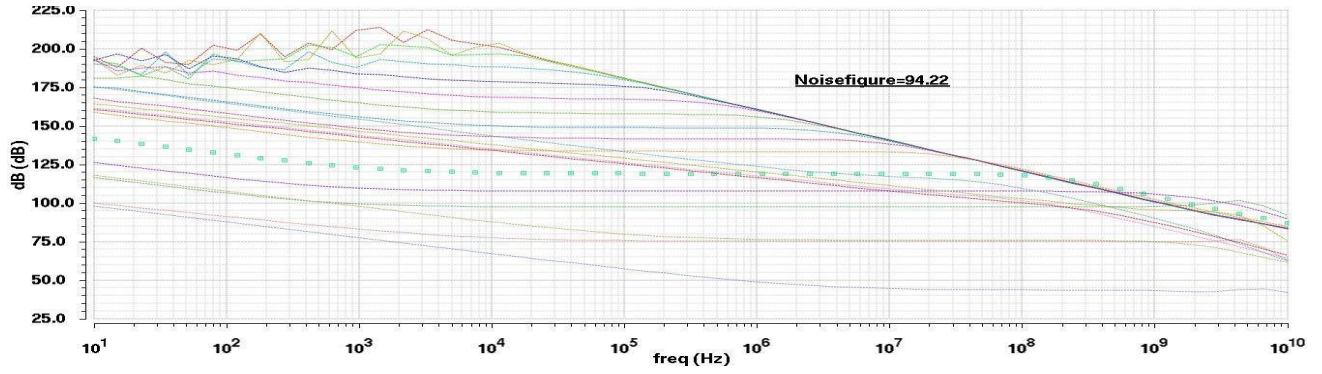**Gain and Phase Plot with respect to frequency of D-X-CCI:**
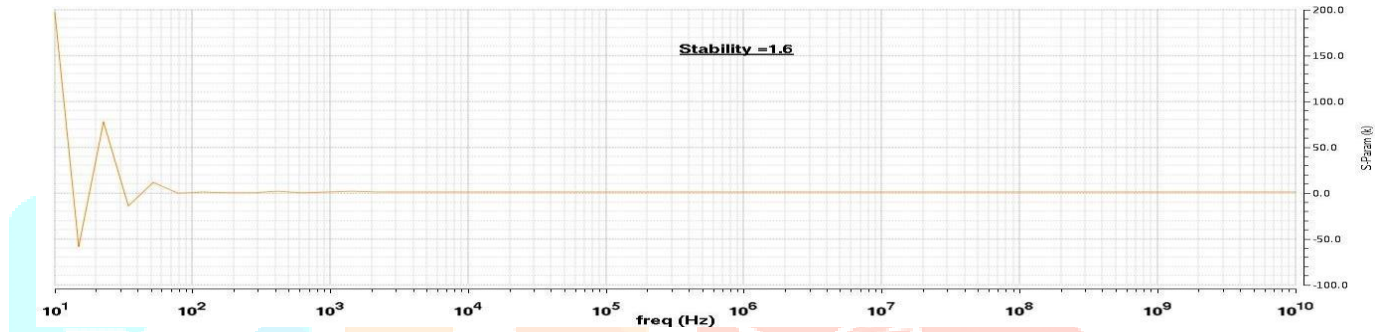

Input Noise Plot of DXCCI:
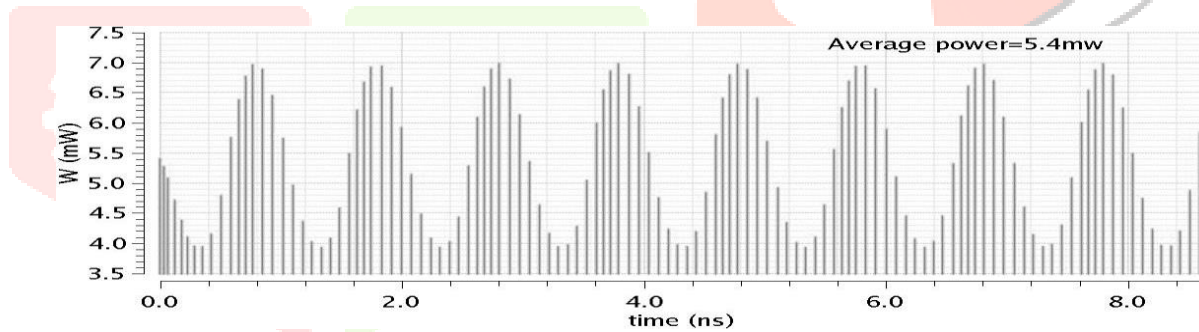

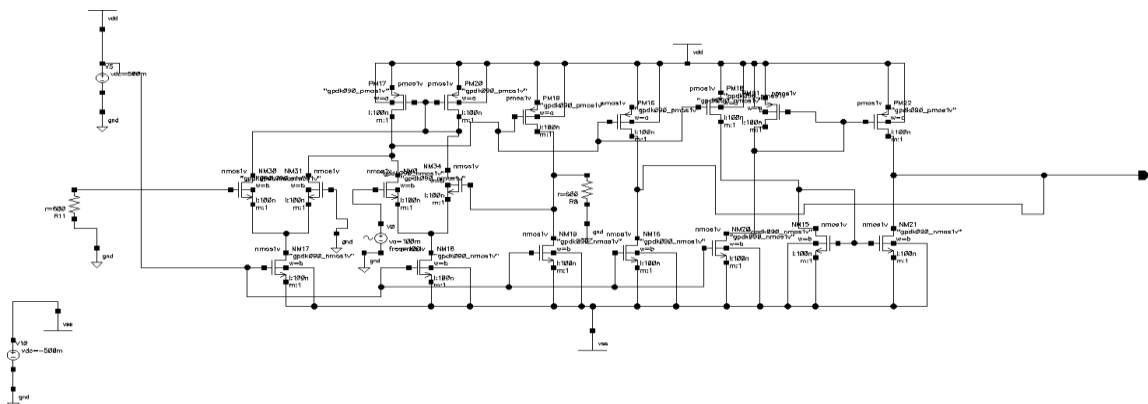**Output Noise Plot of D-X-CCI:**
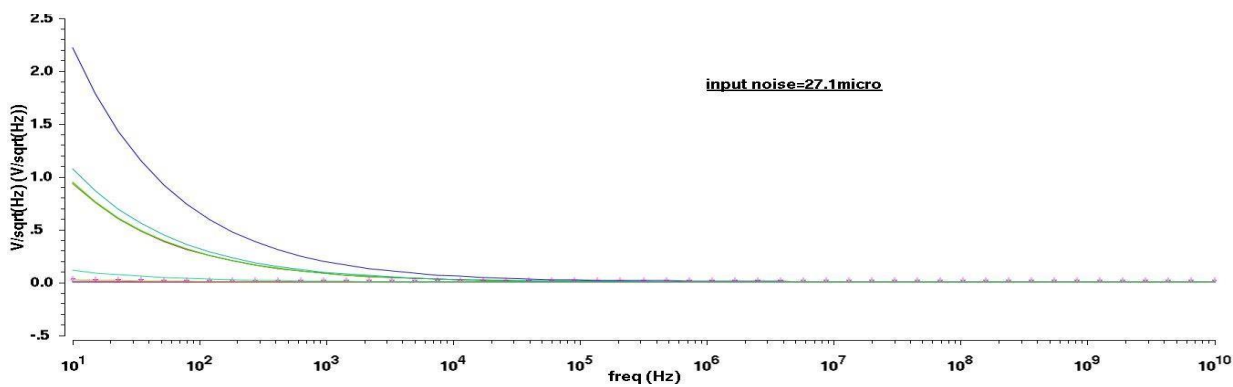
Noise Figure of DXCCI:

Stability of DXCCI:

Power of D-X-CCI:
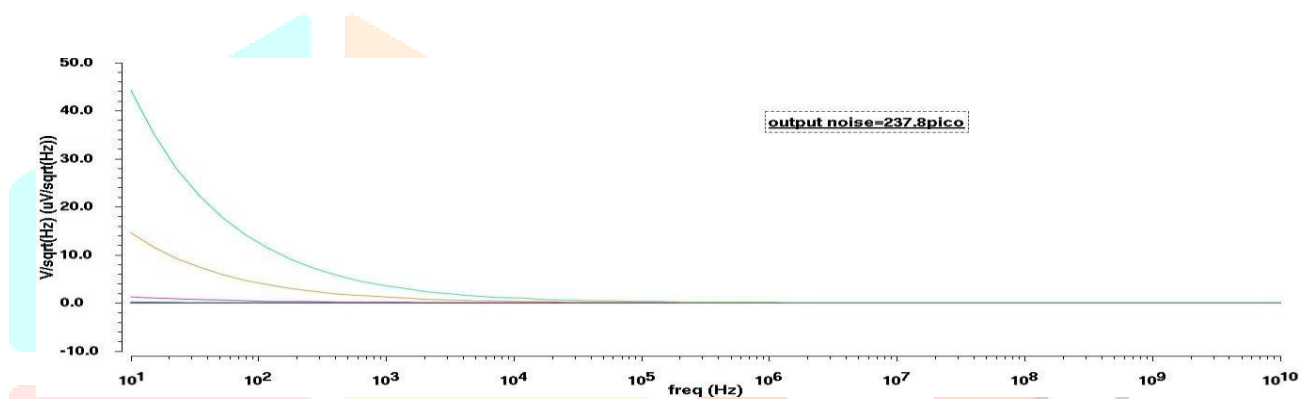
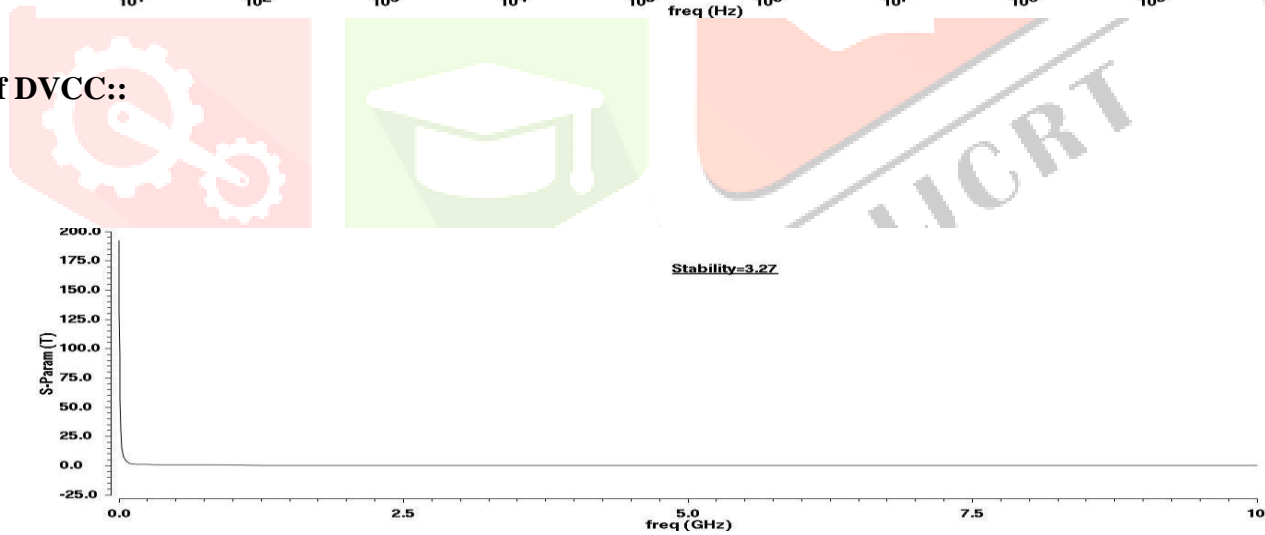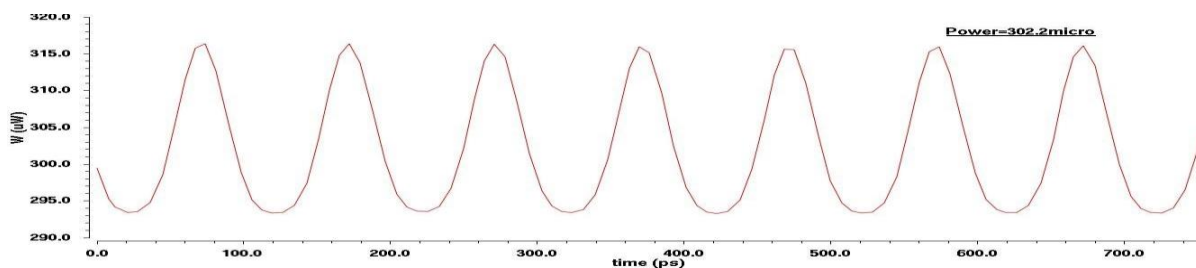

DVCC schematic:

Input Noise of DVCC:

Output Noise of DVCC::

Stability of DVCC::

Power of DVCC:

All Pass Block	Power (watts)	Input noise (dB)	Output noise (dB)	Noise Factor (dB)	Noise figure	Stability	THD (%)	Phase noise (dB)
CCI	1.5m	22.6p	555.6n	258.3	90.3M	6.9	7.45	-132.67
DXCCI	812.6u	4.8p	513.8n	490.3	490.3	13.6	8.148	-156.7
DVCC	302.2u	27.1p	237.8P	3.07	93.67	3.27	16.17	-165.8
DOCCI	5.4m	31.34p	27.39n	23.6	94.22	1.6	17.41	-136.5
Five Transistors Model	1.06m	640.9P	495.6P	16.23	219.3	2.4	8.76	-173.8

Performance and Evaluation of all the proposed Models:

Table 3 Evaluation of proposed all pass filters

The above table shows the evaluation and performance of the proposed all pass filters as the unity gain and the phase shift of 180° is achieved over the 1Ghz bandwidth .To know its efficiency the noise parameters are calculated along with the load resistor added at the output and the its stability defines the withstand over the range of frequencies and to justify the noise parameters a set of 50range of frequencies are passed and its result is evaluated at the precise point. Its characteristics are represented in the pictorial graphs

➢   Input supply for Noise calculations
1.   1v for Vdd
2.   10Ghz band frequency
3.   50mv peak-peak amplitude

CONCLUSION:-

The main aim of this work is to find an feasible solution for designing the all pass filters for transreciever and other electronic devices as it fuses an basic fundamental block for the signal transmission .instead of building different types of filters an all pass filter can be build up with high efficiency in all the parameters .As the par research is held with the Analog Signal processing the usage will the all pass filter merely increases and made incentives to conquer the new designs in regards of the all pass topologies. To make the efficient and accurate model its realizations is made in the Z-Domain and by the reference of the Z-domain realistic nature its equivalent nature behaviour is extracted in the form of the state space equations and with respect to the carrier signal properties the all pass circuit is implemented with desired outputs in all aspects. As the implementation involves in the CMOS process all the desirable characteristics in view of gain. Bandwidth, stability is realised and it eliminates some typical conditions in regard of fabrication and its usage will more for further generations.

As the technology advances in the field of communication for signal processing an efficient Radars and Antenna designs are mainly depend on the all pass filters.In the military applications mainly for the RF frequencies and for oscillators to generate signals, and ultra-high band transreciever the usage of all pass filters is more so there is demand of all pass designs in this field.

ACKNOWLEDGMENT:-

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