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Implementation of High Throughput Soft Output MIMO Detector Using PPTS Algorithm



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Abstract:

In this paper, we propose a path preserving trellis search algorithm and its high speed VLSI architecture for high throughput soft output MIMO detection .we represent the search space of the MIMO system with an unconstrained trellis , where each node represents the possible values transmitted by an antenna. Based on this we convert the soft output MIMO detection problem into a multiple shortest paths .The MIMO detector guaranteed to have soft information for every possible symbol transmitted so that Log likelihood ratio for each will be more accurately formed

The PPTS algorithm is hardware friendly data parallel algorithm because the search operations are evenly distributed among multiple nodes for parallel processing the search complexity is significantly reduced because the number of candidates is greatly limited at each trellis node. By leveraging the trellis structure, we develop an approximate Log-MAP algorithm by using a small list of largest exponential terms to compute the LLR (log-likelihood ratio) values. The trellis-search based detector has a fixed-complexity and is very suitable for parallel VLSI implementation. we are designing and synthesizing high throughput soft-output MIMO detector for a 6×6-36QAM system using a 1.08 V TSMC 65 nm technology. The detector can achieve a maximum throughput of more than 6.4 Gb/s with a small core area

Keywords:

Trellis, shortest path algorithm, high speed communication, MIMO, MIMO receiver.

I. INTRODUCTION:

Multiple-input-multiple-output systems (MIMO) have great potential to increase spectral efficiency by transmitting independent data streams on multiple antennas. As an example, the Vertical Bell Laboratories Layered Space-Time (V-BLAST) system has been shown to achieve very high spectral efficiency. MIMO technologies have been adopted in many new wireless standards such as 3GPP LTE/LTE-Advanced, IEEE 802.16e/802.16m WiMAX, and IEEE 802.11n/802.11ac WLAN. There is an increasing demand for Gbps wireless systems. For example, 3GPP LTE-Advanced, IEEE 802.16mWiMAX, IEEE 802.11acWireless LAN (WLAN), and WIGWAM target for Gbps throughput with MIMO technology.Soft-output MIMO detection poses significant challenges to the MIMO receiver design as the computational complexity increases exponentially with the number of antennas. However, the optimal soft-decision detector, the maximum-a-posteriori (MAP) detector, will consume enormous computing power and require tremendous computational resources which make it infeasible to be used in a practical MIMO receiver. As such, researchers are seeking efficient algorithms to reduce the MIMO detection complexity.Wireless systems are adopting multiple-antenna configurations with spatial multiplexing technique to support parallel streams of wireless data. As an example, the V-BLAST system has been shown to achieve very high spectral efficiency. One bottleneck in such MIMO communication systems is the need to process a large amount of data received at one end of a digital communication channel to detect a noisy signal transmitted simultaneously by a number of transmit antennas. In this paper, a trellis-search based detection algorithm for iterative MIMO detection algorithm can be implemented.



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An unconstrained trellis structure can be used as an alternative to the tree structure to represent the search space of a MIMO signal, trellis-based approximate Log-MAP algorithm as a replacement of the typically used Max-Log algorithm for iterative MIMO detection to find a number of most likely paths for each trellis node and compute a log-sum of a number of exponential terms corresponding to a hypothesized transmitted bit value. Near-optimal performance can be achieved by choosing an appropriate number of surviving paths in the trellis search process.

The trellis-based detection algorithm is a very dataparallel algorithm because the searching operations at multiple trellis nodes can be performed simultaneously. The local search complexity at each trellis node is kept very low to reduce the overall processing time. Moreover, the trellis-based detector can support iterative MIMO detection by utilizing the a prior information from the outer channel decoder.

II. LITERATURE REVIEW:

Mobile wireless connectivity is a key feature of a growing range of devices from laptops and cell phones to digital homes and portable devices. Many applications, such as digital video, are driving the creation of new high data rate multiple antenna wireless algorithms with challenges in the creation of area-time-power efficient architectures

.The mobile telecommunication system has evolved from several Kbps low data rate 1G (for First generation") analog systems to the current 10-100 Mbps enhanced 3G (3.5G, 3.75G, 3.9G) generation. This is soon expected to be followed by 4G with a target data rate of 1 1Gbps. Table 2.1 shows a representative set of mobile wireless standards to highlight their differences in data rates.

Table: 2.1 Major Mobile TelecommunicationStandards

Generation	Technology	Data rates	Year
1G	AMPS, TACS	14.4 KBPS	1981
2G	GSM,CDMA,TDMA	144 KBPS	1995
2.5G,2.75G	GPRS,EDGE,CDMA200 0	~200 KBPS	~200 0
3G	WCDMA,CDMA2000,	384 KBPS	~200 2
3.5G,3.75G .3.9G	HSDPA,LTE,WIMAX	10-100 MBPS	~200 7
4G	IMT-ADVANCED,LTE- ADVANCED	10 GBPS	2012 +

MIMO is the use of multiple antennas at both the transmitter and receiver to improve communication performance. What is the need for MIMO system? The wireless system before MIMO is been constrained by network capacity which is related with channel quality and coverage. To see how problem occurred, we need to talk about the transmission on a multipath channel. In wireless communication the propagation channel is characterized by multipath propagation due to scattering on different obstacle. The multipath problem is a typical issue in communication system with time variations and time spread. For time variations the channel is fading and caused SNR variations. For time spread, it becomes important for suitable frequency selectivity.

In an urban environment, these signals will bounce off trees, buildings, etc. and continue on their way to their destination (the receiver) but in different directions. With MIMO, the receiving end uses an algorithm or special signal processing to sort out the multiple signals to produce one signal that has the originally transmitted data. MIMO exploits the space dimension to improve wireless systems capacity, range and reliability. It offers significant increases in data throughput and link range without additional bandwidth or increased transmit power. MIMO achieves this goal by spreading the same total transmit power over the antennas to achieve an array gain that improves the spectral efficiency (more bits per second per hertz of bandwidth) or to achieve a diversity gain that improves the link reliability (reduced fading). There are many implementations of sphere detectors. However, the sphere detector suffers from non-deterministic complexity and variable-time throughput. The sequential nature of the depth-first tree-search process significantly limits the throughput of the sphere detector especially when the SNR is low.



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The K -Best algorithm is a fixed-complexity algorithm based on the breadth-first tree-search algorithm. Also, each of the states can transition to one of two states of the two outgoing branches, one corresponds to an input bit zero and the other corresponds to an input bit one. On figure the output branch words corresponds to the state transitions appear as labels on the trellis branches. To support iterative MIMO detection, several tree-searches based soft-input soft-output detection algorithms are developed by researchers. However, there are some drawbacks to using the tree-search based detectors. For the depth- first sphere detection, the number of visited nodes is large in the low SNR(signal-to-noise) regime.



Figure 2.1: The simple overview of MIMO

As the number of antenna element increasing, the channel capacity is increased too. Instead of logarithmic-increasing channel capacity in SIMO and MISO system, the MIMO system owned linear-increasing of channel capacity as antenna increased

Table 2.2: Different types of multi antenna systems



III.FUNCTION OF MIMO:

MIMO can be sub-divided into three main categories:

(1)Precoding

(2)Spatial Multiplexing

(3) Diversity coding

Precoding:

Precoding is a generalization of beam forming to support multi-layer transmission in multi-antenna wireless communications. In conventional single-layer beam forming, the same signal is emitted from each of the transmit antennas with appropriate weighting such that the signal power is maximized at the receiver output. When the receiver has multiple antennas, singlelayer beam forming cannot simultaneously maximize the signal level at all of the receive antennas. Thus, in order to maximize the throughput in multiple receive antenna systems, multi-layer beam forming is required. The benefits of beam forming are to increase the received signal gain, by making signals emitted from different antennas add up constructively, and to reduce the multipath fading effect.

Precoding MIMO:

In multi-user MIMO, a multi-antenna transmitter communicates simultaneously with multiple receivers. This is known as Space-Division Multiple Access (SDMA). From an implementation perspective, precoding algorithms for SDMA systems can be sub-divided into linear and nonlinear precoding types. The capacity achieving algorithms are nonlinear, but linear precoding approaches usually achieve reasonable performance with much lower complexity. Linear precoding strategies include MMSE precoding and the simplified Zero-Forcing (ZF) precoding. There are also precoding strategies tailored for low-rate feedback of channel state information, for example random beam forming. Nonlinear precoding is designed based on the concept of dirty paper coding (DPC), which shows that any known interference at the transmitter can be subtracted without the penalty of radio resources if the optimal precoding scheme can be applied on the transmit signal.



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Spatial multiplexing:

Spatial multiplexing requires MIMO antenna configuration. In spatial multiplexing, a high rate signal is split into multiple lower rate streams and each stream is transmitted from a different transmit antenna in the same frequency channel. If these signals arrive at the receiver antenna array with sufficiently different spatial signatures, the receiver can separate these streams into (almost) parallel channels. Spatial multiplexing is a very powerful technique for increasing channel capacity at higher signal-to-noise ratios (SNR). The maximum number of spatial streams is limited by the lesser of the number of antennas at the transmitter or receiver. Spatial multiplexing can be used with or without transmit channel knowledge. Spatial multiplexing can also be used for simultaneous transmission to multiple receivers, known as space-division multiple accessing. The scheduling of receivers with different spatial signatures allows good separability.

IV.MIMO SYSTEM MODEL:

The MIMO systems compared with the conventional single-antenna systems, MIMO systems have the ability to increase the channel capacity by the factor of min (NT, NR) where NT is the number of transmit antennas and NR is the number of receive antennas. Instead of time and frequency, the other dimension space, is used to separate the co-channel data streams and provide the multiplexing gains. By deploying multiple antennas, the increase of data throughput can be realized without sacrificing the power, bandwidth and spectral efficiency. Because of these advantages, MIMO systems have been actively investigated and deployed in broadband wireless access networks such as Mobile WiMAX and LTE-Advanced.

It has been proven that the MIMO wireless channel has the ability to obtain high channel capacity, which has stimulated research on the techniques to achieve high speed data transmission or high link reliability. Therefore, the studies on MIMO systems generally fall into different categories: spatial-multiplexing and diversity techniques , and their relation is studied. On the one hand, the spatial-multiplexing configuration is used in the systems with the aim of achieving the maximum data transmission rate supported by the MIMO channel. On the other hand, when diversity techniques are used, the aim of the system is to increase the reliability and to obtain lower bit error rate.



Figure 2.5 Simplified MIMO System Block Figure 2.5 shows a block diagram of a MIMO

system and highlights the Detection and Decoding blocks that are used to recover the multiple transmitted streams. The number of transmit antennas and transmit streams is typically two or four but could be as many as 8 or 12 infuture systems. The complexity of the detection and decoding algorithms can vary greatly depending on the number of antennas, modulation, and channel code used in the system. An MIMO detector is used to recover and detect the multiple transmitted streams. Soft-output MIMO detection poses significant challenges to the MIMO receiver design as the computational complexity increases exponentially with the number of antennas.

The optimal soft-decision detector, the maximum a posteriori (MAP) detector, will consume enormous computing power and require tremendous computational resources which make it infeasible to be implemented in a practical MIMO receiver. As such, there is a great need for efficient MIMO algorithms to reduce the MIMO detection complexity.Consider a spatialmultiplexing MIMO system with transmit antennas and receive antennas. The MIMO transmission can be modeled as

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y = Hs + n
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where is a complex matrix and is assumed to be known perfectly at the receiver, is a transmit symbol.

Trellis:

The first serious study of trellis structure and trellis construction for linear block codes was due to Wolf. In his 1978 paper, Wolf presented the first method for constructing trellises for linear block codes and proved that an N-section trellis diagram for a q-ary (N, K) linear block code has at most qmla (K,N-K) states.



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He also presented a method for labelling the states based on the parity-check matrix of a code. Right after Wolf's work, Massey presented a simple but elegant paper in which he gave a precise definition of a code trellis, derived some fundamental properties, and provided implications of the trellis structure for encoding and decoding of codes. However, these early works in trellis representation of linear block codes did not arouse much enthusiasm, and for the next 10 years, there was basically no research in this area.

There are two major reasons for this inactive period of research in this area. First, most coding theorists at that time believed that block codes did not have simple trellis structure like convolutional codes and maximum likelihood decoding of linear block codes using the Viterbi algorithm was practically impossible, except for very short block codes. Second, since almost all of the linear block codes are constructed algebraically or based on finite geometries, it was the belief of many coding theorists that algebraic decoding was the only way to decode these codes. These two reasons seriously hindered the development of efficient soft-decision decoding methods for linear block codes and their applications to error control in digital communications. This led to a general belief that block codes are inferior to convolutional codes and hence, that they were not useful.

Trellis-coded Modulation (TCM) is used in band limited communication systems. TCM efficiency improves coding gain by combining modulation and forward error correction coding in one process. In TCM, the bandwidth expansion is not required because it uses the same symbol rate and power spectrum; the differences are the introduction of a redundancy bit and the use of a constellation with double points.

In this thesis, a novel TCM encoder/decoder ASIC chip implementation is presented. This ASIC codec not only increases decoding speed but also reduces hardware complexity. The algorithm and technique are presented for a 16-state convolutional code which is used in standard 256-QAM wireless systems. In the decoder, a Hamming distance is used as a cost function to determine output in the maximum likelihood Viterbi decoder. Using the relationship between the delay states and the path state in the Trellis tree of the code, a precalculated Hamming distances are stored in a look-up table. In addition, an output look-up-table is generated to determine the decoder output. This table is established by the two relative delay states in the code. The thesis provides details of the algorithm and the structure of TCM codec chip. Besides using parallel processing, the ASIC implementation also uses pipelining to further increase decoding speed.

In this work, we propose a trellis-search based detection algorithm for iterative MIMO detection. We use an unconstrained trellis structure as an alternative to the tree structure to represent the search space of a MIMO signal. We propose a trellis-based Approximate Log-MAP algorithm as a replacement of the typically used Max-Log algorithm for iterative MIMO detection. We search the trellis to find a number of most likely paths for each trellis node and compute a log-sum of a number of exponential terms corresponding to a hypothesized transmitted bit value. Near-optimal performance can be achieved by choosing an appropriate number of surviving paths in the trellis search process. The trellis-based detection algorithm is a very data parallel algorithm because the searching operations at multiple trellis nodes can be performed simultaneously. The local search complexity at each trellis node is kept very low to reduce the overall processing time. Moreover, the trellis-based detector can support iterative MIMO detection by utilizing the a priori information from the outer channel decoder.

MIMO Detector:

MIMO detector proposed with a novel path-preserving algorithm and its high-speed VLSI architecture for soft-output MIMO detection. We represent the search space of the MIMO signal with an unconstrained trellis graph. Based on the trellis graph, we convert the soft-output MIMO detection problem into a multiple shortest paths problem subject to the constraint that every trellis node must be covered in this set of paths. The PPTS detector is guaranteed to have soft information for every possible symbol transmitted on every antenna so that the log-likelihood ratio (LLR) for each transmitted data bit can be accurately formed. Simulation results show that the PPTS algorithm can achieve near-optimal error performance with a low search complexity. The PPTS algorithm is a hardware-friendly data-parallel algorithm because the search operations are evenly distributed among multiple trellis nodes for parallel processing.



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Fig 2.6 6×6 QAM system

Table :state diagram of QAM:

Input 1/	Present state (S_I, S_0)	Next state (S_I, S_0)	Output (v1.v2)
0	0.0	0.0	0.0
1	0.0	0.1	1.1
0	0.1	10	11
1	0.1	1.1	0.0
0	10	0.0	10
1	10	0.1	0.1
0	11	1.0	0.1
1	11	1.1	10

V.PROPOSED TRELLIS MODEL FOR ITERATIVE MIMO DETECTION:

This model introduces a trellis model for non iterative MIMO detection and where we assume there is no a priori in- formation available to the detector. The sub optimal Max-Log approximation algorithm was used to compute the LLRs. In this new work, here extend the trellis model introduced in earlier work to support iterative MIMO detection.

The a priori information is incorporated into the path metrics computation to support iterative MIMO detection. We propose a more reliable LLR generation algorithm by re placing the Max-Log algorithm with the multi-term Log-MAP algorithm. We use the trellis model to

find the minimum distances to compute the LLRs as shown in (4). The performance of the proposed algorithm is very close to that of the optimal Log-MAP algorithm while still maintaining low implementation complexity. The search space of a MIMO signal can be represented with a compact trellis diagram. As an example, Figure. 2.6 show the trellis diagram for a 6x6 6-QAM system.

Trellis-Node Shortest Paths Problem:

In the trellis diagram, each trellis node maps to a complex-valued symbol such that each path from the root node to the sink node maps to a symbol vector. With the trellis model, we transform the MIMO detection problem into a per- node shortest paths problem, which is defined as follows. For each node in the trellis diagram, find a list of most likely paths from the root node to the sink node over the node. The most likely paths refer to the paths with the shortest distances or the lowest path weights. For each node, we only keep the most likely paths and will discard all the other paths to reduce the complexity.



Figure 2.7: Flow of the path trace back unit.

Path metric:

Path metric calculates the path metrics of a stage by adding the branch metrics, associated with a received symbol, to the path metrics from the previous stage of the trellis. The add-compare-select unit is the heart of the Viterbi algorithm and calculates the state metrics. These state metrics accumulate the minimum cost of 'arriving' in a specific state. The branch metrics are added to state metrics from

the previous time instant and the smaller sum is selected as the new state metric:

sm1n = min(sm1n-1 + bm1, sm2n-1 + bm3)

 $sm_2n = min(sm_{1n-1} + bm_2, sm_{2n-1} + bm_4)$



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A path metric unit summarizes branch metrics to get metrics for 2^{K-1} paths, where K is the constraint length of the code, one of which can eventually be chosen as optimal. Every clock it makes 2^{K-1} decisions, throwing off wittingly non optimal paths. The results of these decisions are written to the memory of a trace back unit. The core elements of a PMU are ACS (Add-Compare-

Select) units. The way in which they are connected between themselves is defined by a specific code's trellis diagram. Since branch metrics are always ≥ 0 , there must be an

additional circuit preventing metric counters from overflow (it isn't shown on the image). An alternate method that eliminates the need to monitor the path metric growth is to allow the path metrics to "roll over", to use this method it is necessary to make sure the path metric accumulators contain enough bits to prevent the "best" and "worst" values from coming within 2(n-1) of each other. The compare circuit is essentially unchanged.



Figure 2.9: Simple Implementation of Path Metric Unit.

Branch Metric Unit:

The first unit in trellis structure is called a branch metric unit. Here the received data symbols are compared to the ideal outputs of the encoder from the transmitter and branch metric is calculated. Hamming distance or the Euclidean distance is used for branch metric computation. The branch metric unit takes the fuzzy bit and calculates the cost for each branch of the trellis. The branch metric unit consist of several adders and squarer units. In Branch metric its generates a path metrics for each value from input. Traditionally, the MIMO detection problem is usually tackled based on tree-search algorithms. The tree-search algorithms can be often categorized into the depth-first search algorithm and the breadthfirst search algorithm. The sphere detection algorithm is a depth-first tree-search algorithm to find the closest lattice point. To provide soft information for outer channel decoders, a modified version of the sphere detection algorithm, or soft sphere detection algorithm, is introduced. There are many implementations of sphere detectors.



Figure 2.10: Branch metric unit.

The branch metric uses the Hamming distance for the four possible paths. First we initial four different received hamming distance lookup table. Then each time with check the input symbol, we get the four possible distances. The BMU perform simple check and select operations on the decision bits to generate the output. The detail hardware implementation is shown in the Figure 2.11



Figure 2.11 One possible path hardware implementation.

Trace Back:

In the TB method, the storage can be implemented as RAM and is called the path memory. Comparisons in the ACS unit and not the actual survivors are stored. After at least L branches have been processed, the trellis connections are recalled in the reverse order and the path is traced back through the trellis diagram. The TB method extracts the decoded bits; beginning from the state with the minimum PM. Beginning at this state and tracing backward in time by following the survivor path, which originally contributed to the current



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PM, a unique path is identified. While tracing back through the trellis, the decoded output sequence, corresponding to the traced branches, is generated in the reverse order .Trace back architecture has a limited memory bandwidth in nature, and thus limits the decoding speed . When the trellis diagram is finished, the trace-back module will search the ML path from the final state which is stateo to the beginning state which is stateo. Each time, the trace-back block just left shifts one bit of the binary state number and add one bit from the survivor path metric to compute the previous state. By doing this, the most likelihood path is found the control unit receives external instructions or commands which it converts into a sequence of control signals that the control unit applies to data path to implement a sequence of register-transfer level operations.



Figure 2.14: Simple Implementation of a trace back

All the modules are mapped in this module. The structured programming is used in this module. The input signals are clock, start out. The output signals are data out and term out. The output data will be a serial 12 bit data. The trace back unit output gives the final output without any errors, since the errors are corrected during the trace back path.

Trellis Diagram:

The first branching of the tree structure, at time t1, produces a pair of nodes labeled a and b. At each successive branching the number of nodes double. The secondbranching, at time t2, results in four nodes labeled a, b, c, and d. After the third branching, there are a total of eight nodes: two are labeled a, two are labeled b, two are labeled c, and two are labeled d. The processing at thereceiver-side and assumes that the transmitter has no knowledge of the channel matrix and interference statistics.

Volume No: 2(2015), Issue No: 2 (February) www.ijmetmr.com We assess the potential impact of matrix channel knowledge as well as interference statistics at the transmitter on channel capacity under spatially and temporally correlated interference. Assuming the receiver has perfect knowledge of the channel matrix and interference statistics. the trellis-search based detector is the low sorting cost compared to the K -best detector. In the detailed analysis and comparison of the sorting complexity and the partial Euclidean distance (PED) computation complexity for the trellis detector.



Figure 2.15:Trellis diagram.

All branches emanating from two nodes of the same state generate identical branch word sequences. From this point on, the upper and the lower halves of the tree are identical. The reason fotr this should be obvious from examination of the encoder in Figure 2.1. As the fourth input bit enters the encoder on the left, the first input bit is ejected on the right and no longer influences the output branch words. Consequently, the input sequences $1 \circ 0 \times y \ldots$ and $0 \circ 0 \times y \ldots$, where the leftmost bit is the earliest bit, generate the same branch words after the (K = 3)rd branching. This means that any two nodes having the same state label at the same time ti can be merged, since all succeeding paths will be indistinguishable.

If we do this to the tree structure of Figure 2.4, we obtain another diagram, called the trellis diagram. The trellis diagram, by exploiting the repetitive structure, provides a more manageable encoder description than does the tree diagram. The trellis diagram for the convolutional encoder of Figure 2.1 is shown in Figure 2.5. In drawing the trellis diagram, we use the same convention that we introduced with the state diagram—a solid line denotes the output generated by an input bit zero, and a dashed line denotes the output generated by an input bit one.



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The nodes of the trellis characterize the encoder states; the first row nodes correspond to the state a = 00, the second and subsequent rows correspond to the states b = 10, c = 01, and d = 11. At each unit of time, the trellis requires 2K - 1 nodes to represent the 2K - 1 possible encoder states.

State Machine Control Unit:

The control unit coordinates the input and output devices of a computer system. It fetches the code of all of the instructions in the micro programs. It directs the operation of the other units by providing timing and control signals. All computer resources are managed by the CPU. It directs the flow of data between the CPU and the other devices. The control unit is the circuitry that controls the flow of data through the processor, and coordinates the activities of the other units within it.

In a way, it is the "brain within the brain", as it controls what happens inside the processor, which in turn controls the rest of the computer. The examples of devices that require a control unit are CPUs and graphics processing unit (GPUS). The modern information age would not be possible without complex control unit designs.

The control unit receives external instructions or commands which it converts into a sequence of control signals that the control unit applies to data path to implement a sequence of register-transfer level operations. Finite-state machines can model a large number of problems, among which are electronic design automation, protocol design, parsing and other engineering applications.

VI EVALUATION:

The implementation of high throughput soft output MIMO detector using PPTS algorithm is logically verified using XILINX 10.1 and MODELSIM SE 6.3. Synthesis and Implementation is done using Xilinx Spartan-3E Fpga Board of device family xc3s500e-4fg320.The simulation results are as shown in figures.

Simulation Results:

Simulation of main module is shown below



In the above figure din are input and originals are output where originals are the output of the Encoder



RTL schematic of Trellis MIMO Detector

VII CONCLUSION & FUTURE SCOPE:

In this paper, a trellis-search based iterative MIMO detector which can achieve a higher throughput than the traditional tree-search based detectors. The proposed detector employs a path metric and traces back operation in a MIMO trellis where a predefined number of candidates are retained at each trellis node, and a path extension operation where the trellis is ex- tended to fill in the missing paths. The proposed detection algorithm guarantees that a fixed number of path metrics can be found with respect to each hypothesized value of a transmitted bit. The synthesized trellis search based MIMO detector design is implemented on XIL-INX SPARTAN 3 XCS400 FPGA. The design is simulated for functionality by using Xilinx ISE simulator tool.



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The trellis-based detector has low complexity and low latency. As the next generation wireless systems are targeting multiple Gb/s data rate, the proposed detector provides a feasible solution for realizing such a high data rate system. To provide the less search complexity over the trellis diagram we can use iterative MIMO detector. The trellis stages in Trellis based MIMO detector can be extended up to 10 stages

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