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Results. Description

Wireless Mobile Simulator (WiMo-SIM)

1. Introduction

This document gives a brief description of all the variables which can be found in the *.mat* file generated by WiMo-SIM after a simulation. In the list presented, the type of each variable is placed between brackets on the left of it. Additionally, there could appear the dimension associated to the variable between parentheses on the right of it.

2. Results Description

This section gives a description of the system outputs.

- *[vect]BER (1 x nUsers)*: Bit Error Rate (BER) per user by comparing transmitted and received bits.
- *[vect]BLER (1 x nUsers)*: BLock Error Rate (BLER) per user by comparing transmitted and received transport blocks (TB).
- *[vect]BLER_CRC (1 x nUsers)*: BLER per user, which has been calculated by checking the Cyclic Redundancy Code (CRC) of each transmitted TB. The main difference with the output *BLER* is that an error free received TB could be discarded if there is any error during the reception of its attached CRC.
- *[vect]BitLossRate (1 x nUsers)*: Number of bits that are discarded from queues per user. Bits are discarded when queues are full and new bits are received from the traffic source.
- *[vect]DiscardedPackets (1 x nUsers)*: Number of packets per user that are discarded from queues when they exceed the maximum time allowed in queues. This time is given by the *delayThreshold* parameter when the scheduling algorithm selected is *hardPriority*, *softPriority* or *weightPriority*.
- *[vect]DiscardedPacketsSize (1 x nUsers)*: Position ‘i’ contains the size of the packets (expressed in bits) that have been discarded since its associated delay have exceeded the limit delay established by the *delayThreshold* parameter [1].
- *[matrix] QueueDelay (nUsers x iterationsNumber*10)*: In position ‘i’j’, time (expressed in number of subframes) that the *j*th packet of the *i*th user has been in the queue until the transmission of this packet starts. This output is only significant when the Full Buffer option is not selected.
- *[vect]Received_TBs (1 x nUsers)*: Number of TBs which have been received per user, including TBs with errors.
- *[vect]SINRdB (1 x nUsers)*: Mean Signal to Interference and Noise Ratio per user, expressed in dBs.

- *[matrix]averageSnrPerChunk* ($nUsers \times nPRBs \cdot nCodewords / prbPerChunk$): Matrix with as many rows as number of users ($nUsers$) and as many columns as number of physical resource blocks (PRBs) in the bandwidth ($nPRBs$) simulated multiply by the number of codeword ($nCodeword$) and divided by the size of the chunk (defined by the parameter *cqiChunk*). Each position of a row contains the average SINR expressed in dBs of each chunk in which the bandwidth has been divided.
- *[matrix]averageSnrPerPrb* ($nUsers \times nPRBs \cdot nCodewords$): Matrix with as many rows as number of users ($nUsers$) and as many columns as number of PRBs in the bandwidth ($nPRBs$) simulated multiply by the number of codeword ($nCodeword$). Each position of a row contains the average SINR of each PRB expressed in dBs.
- *[vect]averageTxNo* ($1 \times nUsers$): Averaged number of transmissions per TB associated to each user.
- *[vect]average_tbSize* ($1 \times nUsers$): Averaged size of transmitted TB for each user in bits.
- *[vect]burstNumber* ($1 \times nUsers$): Number of subframes that contains a TB intended for each specific user.
- *[matrix]delayHistogram* ($nUsers \times iterationsNumber \cdot nCodewords + 2$): Position 'i''j' contains the time (expressed in number of subframes) which has been spent in the transmission of the jth packet of the ith user. This value includes the time spent waiting in the queue in order to be served and the time spent in the transmission in order all the TB associated to the packet are received without error. If the value of the position 'i''j' is -1, it means that the jth packet of the ith user has been discarded. This output is only significant when the Full Buffer option is not selected and it only is calculated when the option *saveHistograms* is activated [1].
- *[vect]disorderPackets* ($1 \times nUsers$): Number of packets whose segments have been correctly received disorderly for each user.
- *[vect]erroneusDiscardedTB* ($1 \times nUsers$): Each element represents the ratio between the total number of discarded TB and the total number of transmitted TB for each user. A TB is discarded if it is not correctly detected after *maxHarqReTxNo* retransmissions [1].
- *[vect]errorBits* ($1 \times nUsers$): Each element represents the total number of bits that have not been correctly detected.
- *[vect]estMSE* ($1 \times nPaths$): This output is a vector whose number of elements is equal to the number of paths ($nPaths$) in the MIMO configuration (i.e. each path is the way between a transmitting antenna and a receiving antenna). Each

element contains the Mean Square Error (MSE) of the channel estimation of each path. In case there are several simulated users, only the MSE associated to the first user is given.

- *[vect]goodput (1 x nUsers)*: Each element represents the number of correctly detected bits for each user.
- *[matrix]instBLER (nUsers x iterationsNumber+2)*: This output contains a matrix with as many rows as number of simulated users and as many columns as number of iterations. Position 'i''j' contains the instantaneous BLER associated to the *i*th user in the *j*th iteration.
- *[vect]maxTxNo (1 x nUsers)*: Position 'i' contains the maximum number of transmissions done by the *i*th user to transmit a TB (first transmission plus number of retransmissions).
- *[vect]meanAssignSize (1 x nUsers)*: Position 'i' contains the mean number of PRBs assigned to the *i*th user along the simulation.
- *[vect]meanPacketDelay (1 x nUsers)*: Position 'i' contains the mean packet delay expressed in number of subframes associated to the *i*th user. This output is only significant when the Full Buffer option is not selected.
- *[vect]nPacketLost (1 x nUsers)*: Position 'i' contains the number of lost packet associated to the *i*th user. One packet is discarded when at least one of the received TBs in which this packet is segmented is received with errors.
- *[vect]nPacketsRx (1 x nUsers)*: Number of correctly received Radio Link Control (RLC) packets per user.
- *[vect]nPacketsTx (1 x nUsers)*: Number of transmitted RLC packets per user.
- *[int]numberTx*: This output represents the number of users simulated.
- *[vect]packetLosses (1 x nUsers)*: Position 'i' contains the number of lost packet in the queue associated to the *i*th user. A packet is lost in the queue when it arrives to the user queue and there is not enough space to queue it.
- *[matrix]packetSizeHist (nUsers x iterationsNumber·nCodewords+2)*: Position 'i''j' contains the size (expressed in bits) associated to the *j*th packet of the *i*th user. This output is only significant when the Full Buffer option is not selected and it only is calculated when the option *saveHistograms* is activated [1].
- *[vect]packetErrorRate (1 x nUsers)*: Packet Error Rate (PER) per user of the RLC layer compute as $nPacketsLosses/nPacketsTx$. One packet is discarded when at least one of the received TBs in which this packet is segmented is received with errors.

- *[vect]residualBer* ($1 \times nUsers$): Position 'i' contains the number of erroneous bits considered valid bits (because they have not been detected by CRC) associated to the *i*th user.
- *[vect]sGain* ($1 \times nUsers$): Position 'i' contains the transmitted power, taking into account path loss, associated to *i*th user (expressed in watt).
- *[scalar]seed*: This output contains the value of the seed employed in the simulation to generate the random variables.
- *[vect]totalBits* ($1 \times nUsers$): Position 'i' contains the number of total bits transmitted by the *i*th user.
- *[matrix]txNoHistogram* ($nUsers \times iterationsNumber \cdot nCodewords + 2$): Matrix with as many rows as number of simulated users and as many columns as number of codewords multiply by number of iterations plus 2. Position 'i''j' contains the number of transmission done by user 'i' in subframe 'j'. This output is only computed when the option *saveHistograms* is active [1].

3. Types

This section briefly shows the different types associated to the parameters.

- [string] : Vector of chars in order to store names of files, folders, parameters, etc.
- [bool] : Boolean value that can be true or false.
- [int] : Integer value.
- [scalar] : Real value.
- [vect] : Vector of real values.
- [matrix]: A two dimension vector of real values.

4. Acronyms

BER	Bit Error Rate
BLER	Block Error Rate
CRC	Cyclic Redundancy Code
MSE	Mean Square Error
PER	Packet Error Rate
PRB	Physical Resource Block
RLC	Radio Link Control
SINR	Signal to Interference Noise Ratio
TB	Transport Block
WiMo-SIM	Wireless Mobile SIMulator

5. References

- [1] Params_Description_v2.1.doc