# Appendix A

## User manual for GUI of Embedded Architecture Using Soft-Computing Techniques for Parametric Optimization of MIMO Wireless System

# Appendix A: User manual for GUI of Embedded Architecture Using Soft-Computing Techniques for Parametric Optimization of MIMO Wireless System

GUI is developed for "Design and Implementation of Embedded Architecture Using Soft-Computing Techniques for Parametric Optimization of MIMO Wireless System". GUI is user friendly environment using which the MIMO Capacity analysis and throughput analysis of proposed algorithms in the research work is carried out. Also, the real-time implementation on Atlys Spartan 6 Development kit and TMS320C6713 DSK is carried out. Following is the operating procedure for GUI with description.

## Operating Procedure of GUI

1) Open the GUI by writing "Softcomputing_ for_ MIMO_ Systems" in MATLAB Command window. Figure A. 1 shows the GUI for "Design and Implementation of Embedded Architecture Using Soft-Computing Techniques for Parametric Optimization of MIMO Wireless System".


Figure A. 1: GUI for Design and Implementation of Embedded Architecture Using Soft-Computing Techniques for Parametric Optimization of MIMO Wireless System

The menu bar gives the options to view documents (synopsis, thesis and user manual) and to open other GUI for performance analysis of MIMO Wireless Simulator, ANN based Channel Estimation and FL Decision model for MIMO mode switching.

2) MIMO Wireless Simulator is a user friendly GUI based simulator for Capacity and performance analysis of MIMO Wireless System as shown in Figure A. 2. Two MIMO transmission techniques: Spatial Multiplexing and Diversity Techniques can be analyzed using the simulator.

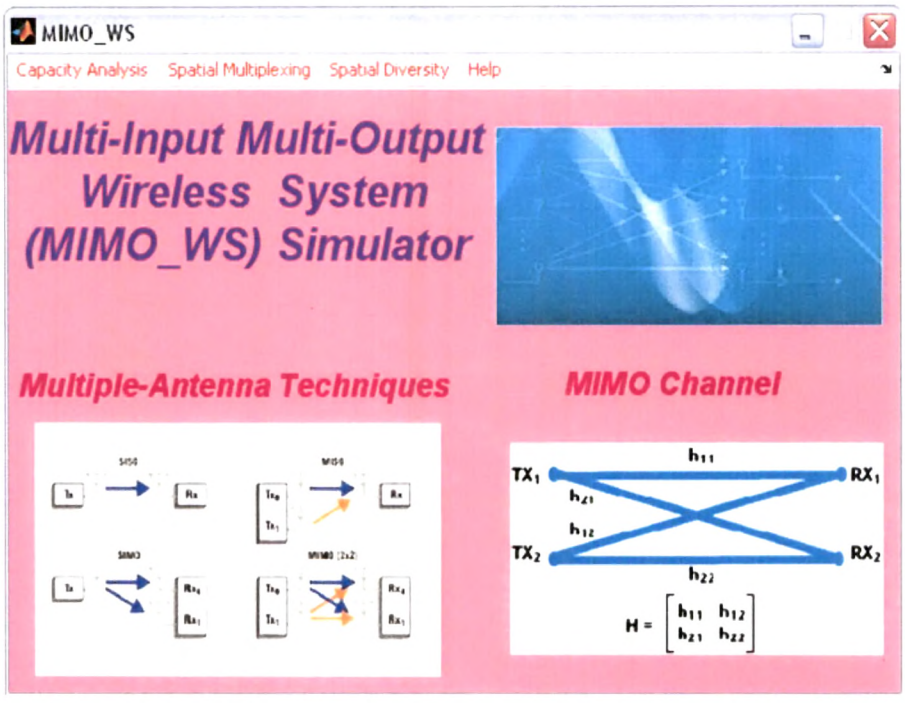


Figure A. 2: GUI for MIMO Wireless Simulator

As shown in Figure A. 3 MIMO-WS is able to carry out the Capacity Analysis for various antenna configurations, performance analysis for Spatial Multiplexing- V-BLAST technique for different receivers. It can also do the analysis of various spatial diversity techniques like MRC, Alamouti, OSTBC and STTC. From the selection of techniques from menu editor, another GUI window pop ups, and the user can vary parameters like Antenna Configuration (2X2, 4X4 or 8X8) and Type of Modulation ( BPSK, QPSK, 8-PSK, 16-PSK) as shown in Figure A. 4. When the user pushes the push button labeled with "PLOT", the BER v/S SNR plot is displayed. For comparative analysis the user can "HOLD FIGURE" and select other configurations and can "PLOT" the graph for further analysis. The "CLEAR FIGURE" push button will clear the axes for other plots.


Figure A. 3: Features of MIMO Wireless Simulator

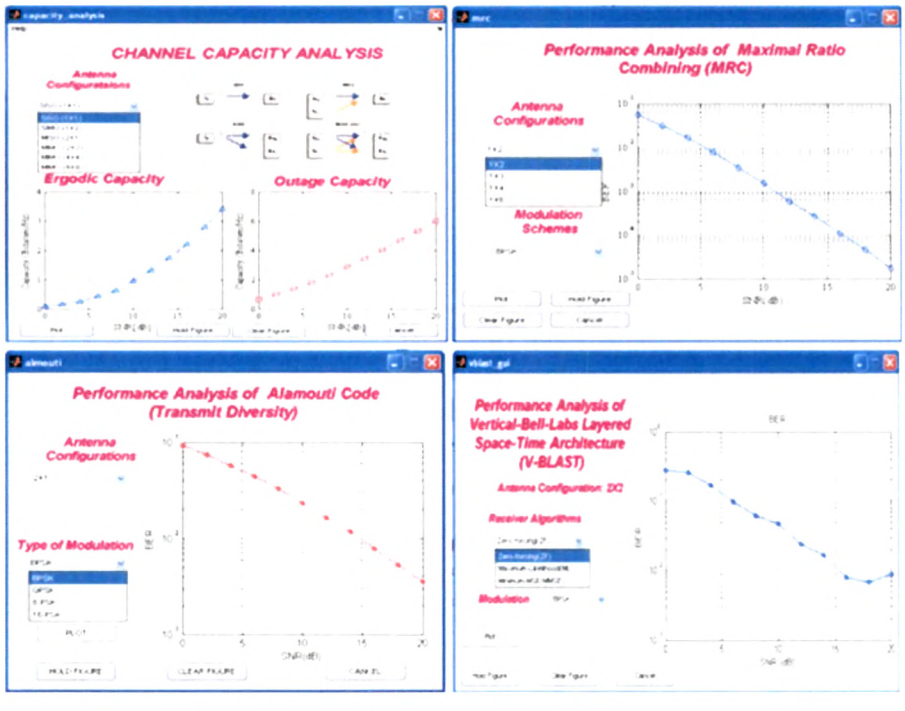


Figure A. 4: MIMO WS GUIs for performance analysis

The GUI for STTC Code Design and performance analysis is as shown in Figure A. 5. The STTC GUI gives option to select the Code design or performance analysis through radio buttons.

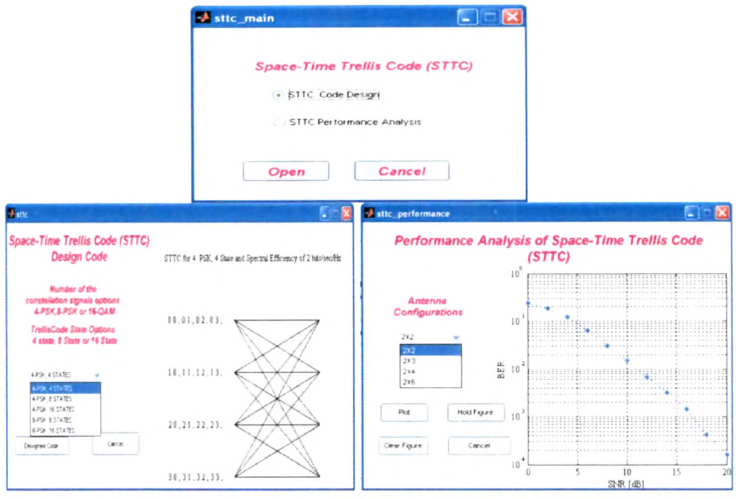


Figure A. 5: STTC performance analysis GUI

3) From the menu bar FL Decision model for MIMO mode, it opens the GUI for "Throughput Analysis for Fuzzy Logic Decision model for MIMO mode switching in LTE-A Downlink Physical Layer" as shown in Figure A. 6. The GUI allows user to set initial simulation parameters using the pop-up menus. "RUN in MATLAB" push buttons starts the simulation and displays the throughput and elapsed time for User parameters.

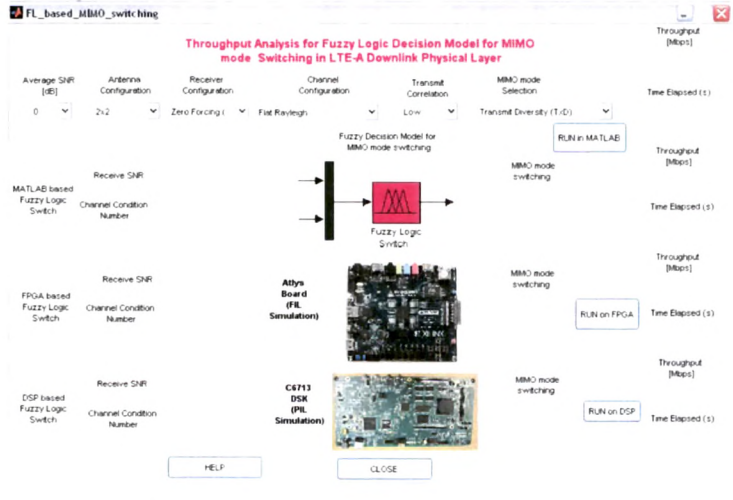


Figure A. 6: GUI for FL decision model for MIMO mode switching

For real-time implementation on Atlys board, connect the USB cable, power supply and Gigabit

Ethernet cable to the kit. Then open the Simulink model "fuzzy_ switching_ modified_ fixedpoint_ new". Then double click the FIL model, from the Function Block parameters, Load the program to the XUP Atlys board as shown in Figure A. 7. The implementation is done using the push button "RUN on FPGA".

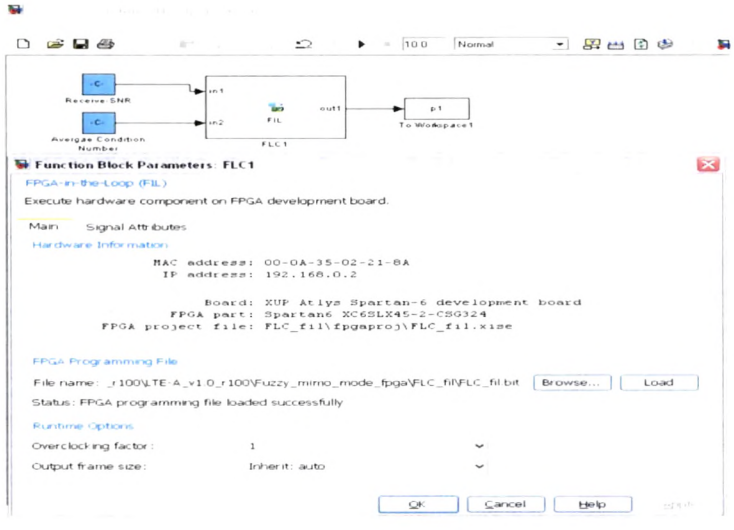


Figure A. 7: Programming XUP Atlys board through MATLAB FIL model

For real-time implementation on TMS320C6713 DSK, connect the USB cable and power supply to the kit. Then open the Simulink model "fuzzy_ switching_ fixedpont_ pil". Set the Configuration parameters as shown in Figure A. 8.

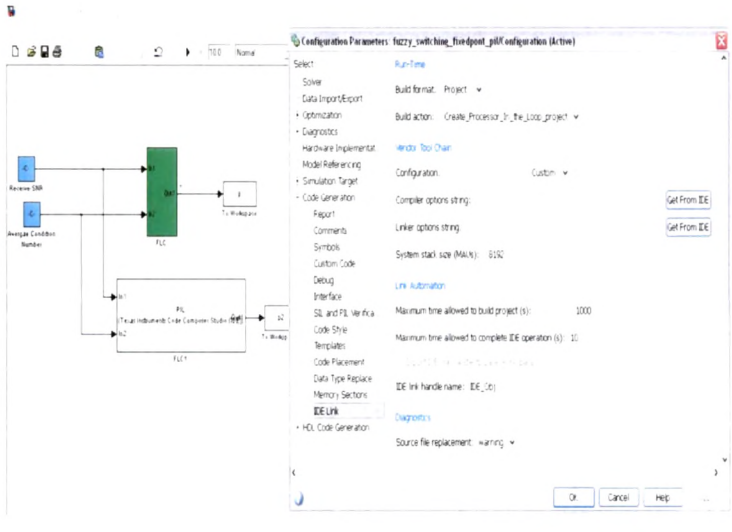


Figure A. 8: Programming C6713DSP through MATLAB PIL model

Then right click the FLC model, and Build Subsystem. The Connectivity Configuration to CCS is generated and is automatically connected to CCS and the PIL block is created. Connect the PIL model in the Simulink file and the output To Workspace. The implementation is done using the push button "RUN on DSP". The results are viewed in GUI.

4) From the menu bar ANN based Channel Estimations, it opens the GUI for "Throughput Analysis for ANN based MIMO channel estimation in LTE-A Downlink Physical Layer" as shown in Figure A. 9.

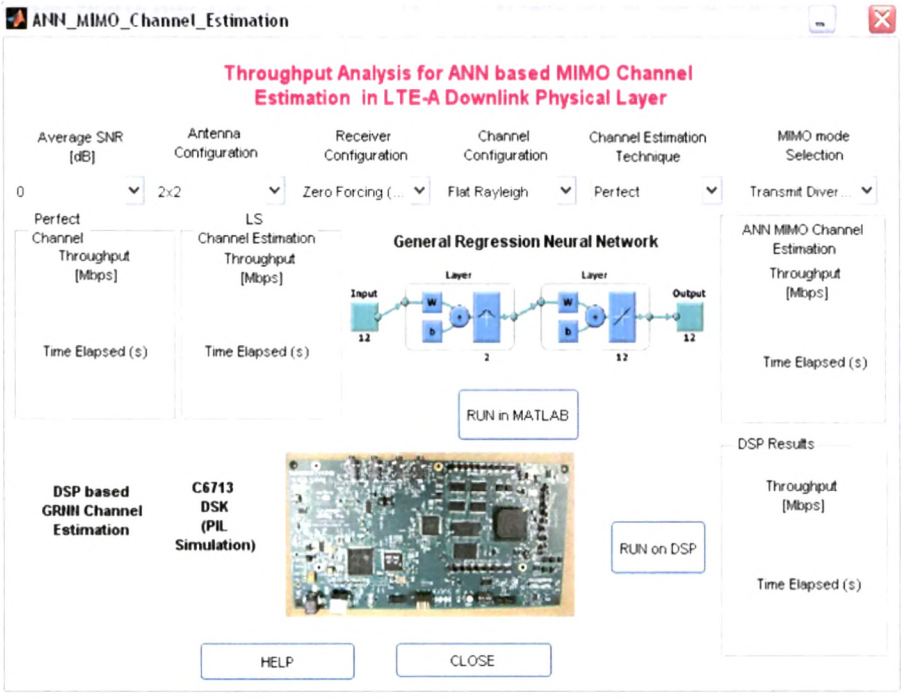


Figure A. 9: GUI for Throughput Analysis for ANN based MIMO channel estimation

For real-time implementation on TMS320C6713 DSK, connect the USB cable and power supply to the kit. Then open the Simulink model "grnn_ channelest_ pil". Follow the similar procedure as in Step 3 for implementation on DSP. The implementation is done using the push button "RUN on DSP". The results are viewed in GUI.