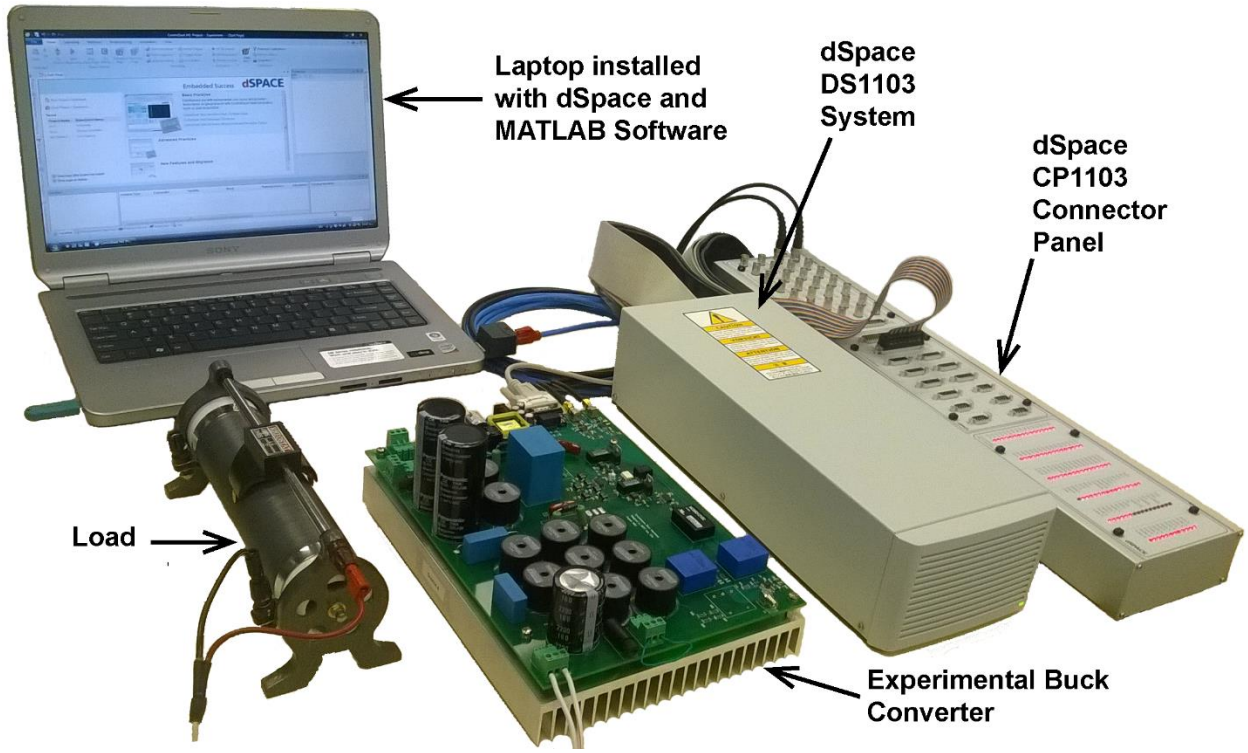
Report on the dSPACE Experiments for Hysteresis Controlled Buck Converter

System Hardware Requirements: This requires DS1103 System Board, Dongle Key for licensing, Microtec PowerPC C Compiler (that generates executable code for DS1103 PowerPC processor) and CP 1103 Connector Panel. The host PC should be x86-compatible with host processor at least Pentium 4 at 2GHz, 1 GB RAM, and DVD drive for software installation.

System Software Requirements: MATLAB/SIMULINK Release 2014a, Real-Time Interface (RTI), and ControlDesk Next Generation. Software compatibility information is available on: https://www.dspace.com/en/inc/home/support/supvers.cfm

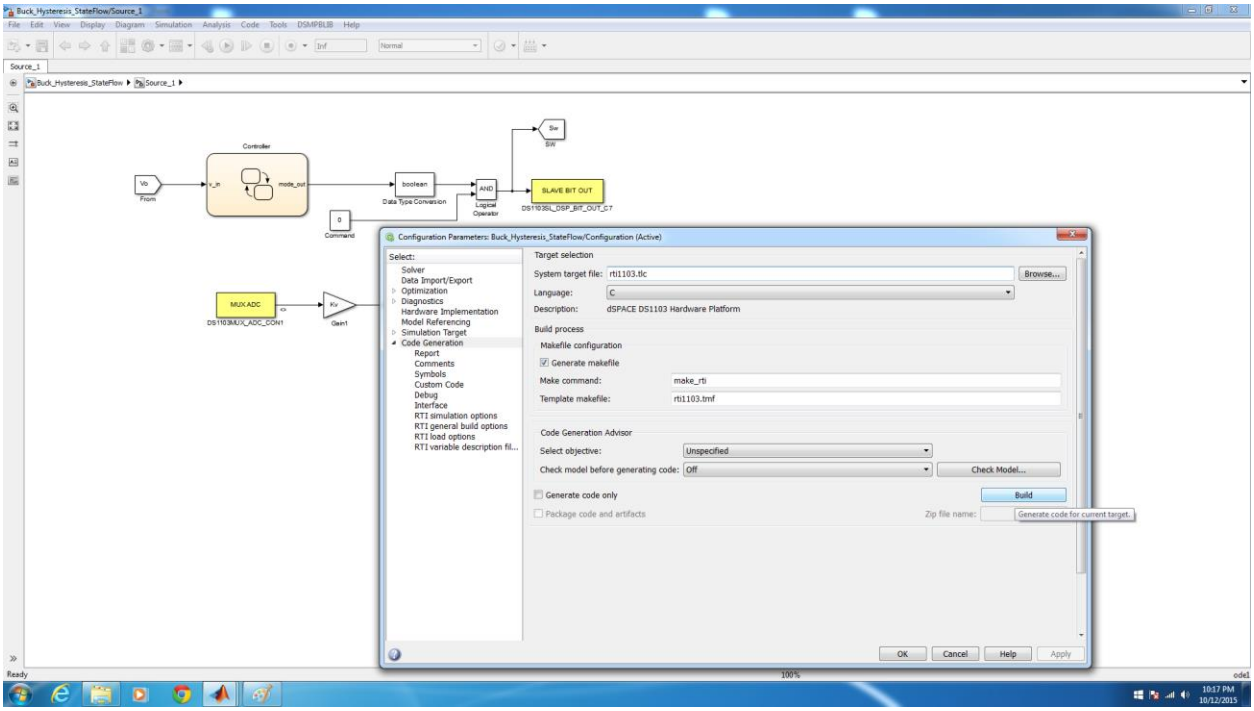
The experimental setup is shown below:



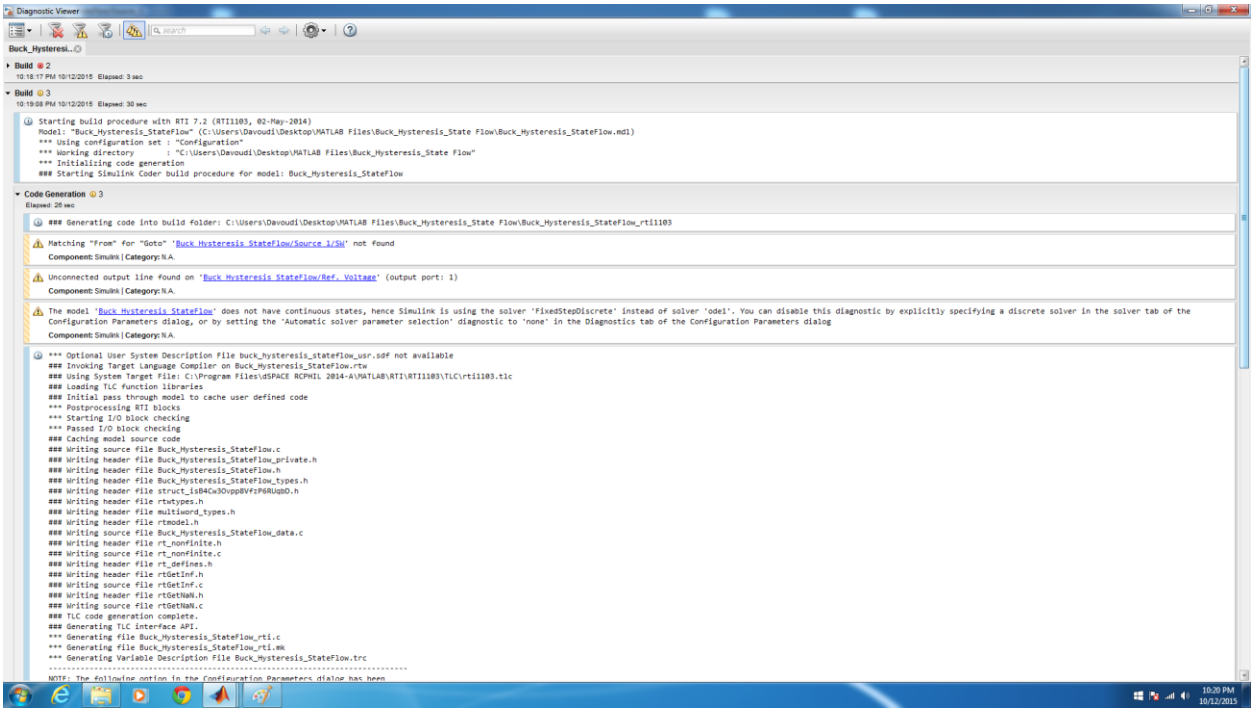
Code Generation Process:

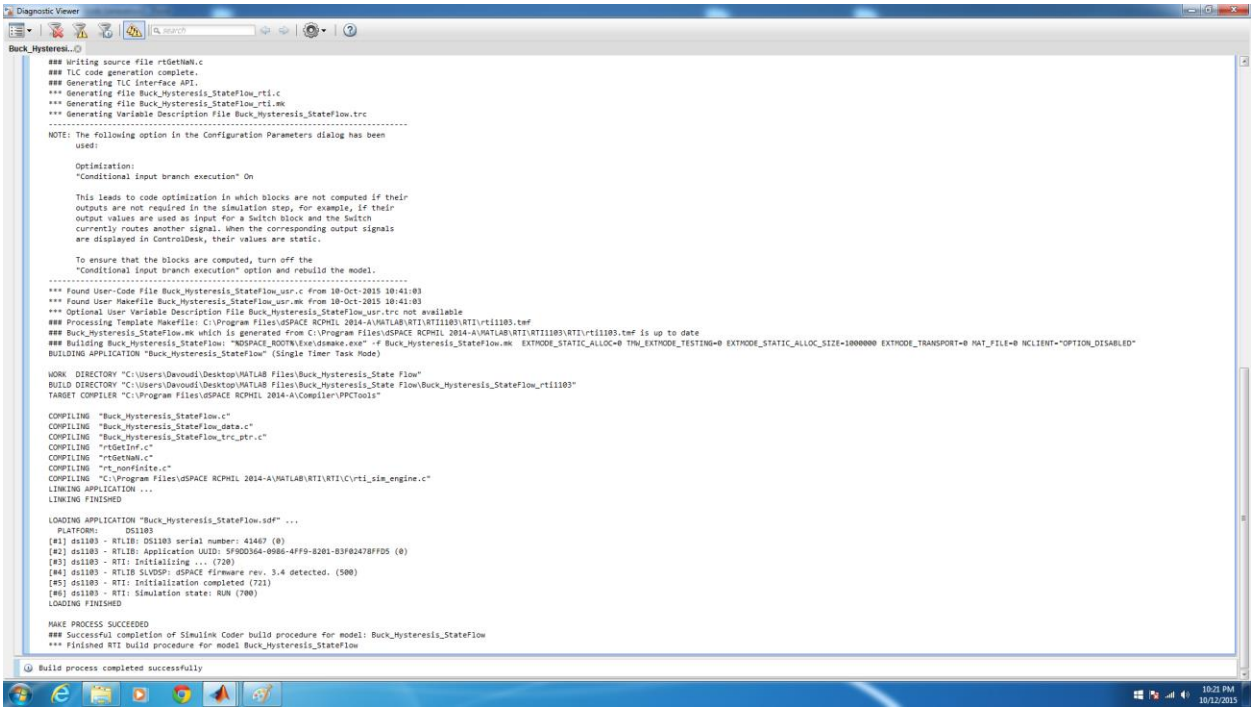
The first step towards code generation is to build a Simulink/Stateflow (SLSF) model that has the software interface between the controller and the plant. This software interface is provided by the Real-Time Interface (RTI) Block library (Type 'rti' in MATLAB command window to display the library). The I/O resources for DS1103 system are split between the two processors on the board, i.e., Master PPC (Power PC) and Slave DSP F240. The user may select any of these I/O resources to use these as interface between the controller and the plant as per requirement.

Once the model is ready, the next step is to generate the C code. From Simulink model, use "Simulation => Configuration Parameters => Code Generation => Build" as shown in screenshot below:



C code is then automatically generated, compiled and linked by the Power PC processor in DS1103. If there is any error during the build process, the user is notified through the "Diagnostic Viewer" in MATLAB. Upon successful completion of the build process, the user is notified with message "Make Process Succeeded" in the Diagnostic Viewer within MATLAB. Different phases of code generation are shown in screenshots below:





<u>Resources Used from dSpace DS1103 System:</u>

Using Real-time Interface (RTI), we can include the resources from these boards in SLSF model. In our experiment, we have used following two resources of dSpace system using RTI in Stateflow models.

1. For Data Flow from Plant to Controller: We have used multiplexed ADC (of Master Power PC) to feed the voltage to the controller.

2. For Data Flow from Controller to Plant: The controller produces on/off pulses for the MOSFET switch of the plant. The Boolean valued signal is fed to the Buck converter using the I/O channel (of the Slave TI DSP). The controller generates non-periodic pulses based on the hysteresis band.