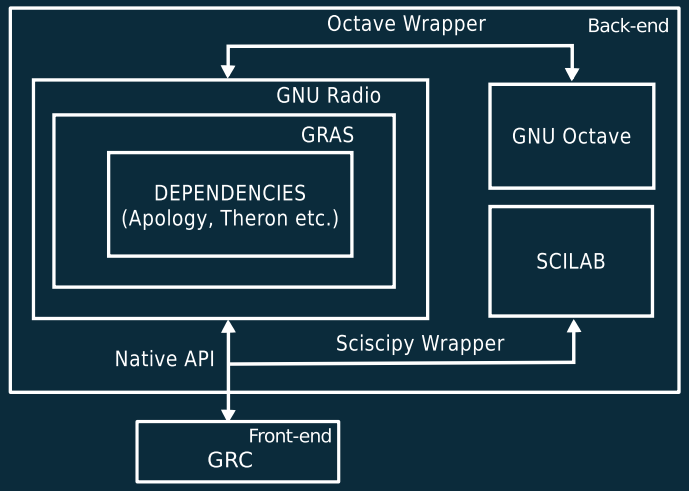
Introduction to Sandhi

Sandhi is a **free and open source** visual programming language and editor to replace applications built using LabVIEW. It is developed on GNU Radio and GRAS scheduler.

GNU Radio is a free & open source software development toolkit that provides signal processing blocks to implement software radios. GRAS is an application scheduler that uses new features, performance enhancements, and a simplified user API. It is capable of supporting feedback systems. Hence, Sandhi's framework is flexible enough to enable users to design and simulate their own set of experiments. It also has provision to connect external hardware devices.



Architecture

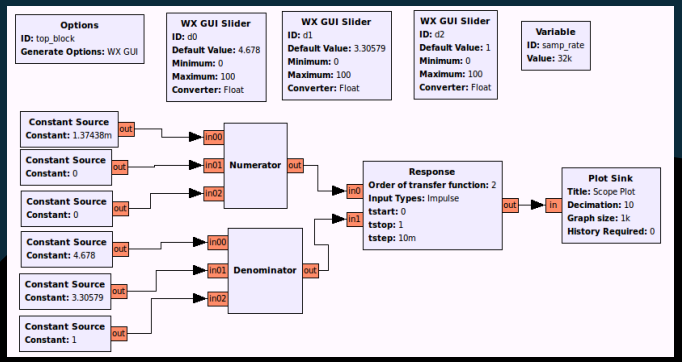
- The backend of Sandhi consists of GNU Radio, GRAS and other dependencies like Apology, Theron, PMC etc.
- GNU Radio performs signal processing and has blocks/eleme-nts of its own
- GRAS scheduler is implemented to support feedback systems
- Sandhi can be combined with other computational software like Scilab, GNU Octave
- GNU Radio communicates with Scilab, GNU Octave and GRC through Sciscipy, Octave & Native API wrappers
- The front-end of Sandhi consists of GRC (GNU Radio Compa-nion) in which visual programming is done

Features

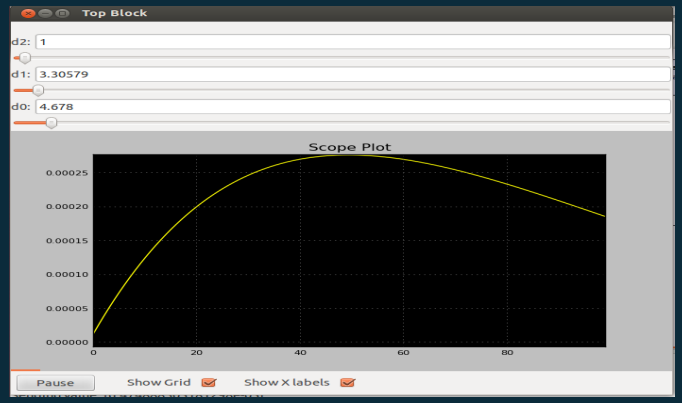
- Interactive and user friendly GUI
- Customised blocks can be designed using Python, C++
- It supports connections to external hardware devices like SBHS, Bio-reactor, Open PLC etc.
- Uses Scilab and Python for scientific calculations
- Ability to generate control system data flow graphs
- Auto-checks if connections are correct
- Outputs are shown in the form of graphs/ calculated values
- Inputs can be dynamically changed with the help of sliders

Example

Transient Response of Transfer Function



Flow Graph of Transient Response



Output of Transient Response

Applications

Sandhi can be used in Virtual Lab experiments.

Eg. Single Board Heater System (SBHS)

- Users can remotely access the Single Board Heater Systems hosted at IIT Bombay, and perform various experiments.
- Single Board Heater system is a lab-in-a-box setup which is primarily used for teaching/studying the theory of control systems. It can be thought of as a plant with a very small time constant (of the order of 30s).
- Users can remotely access this system and perform experim-ents on it from tests as simple as Step Tests to complicated closed loop tests.