

Group 5-6

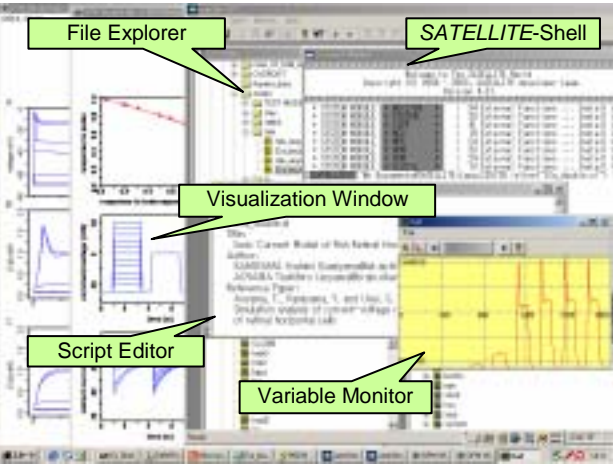
SATELLITE : The integrative support environment  
for modeling and simulation

Yasuo Fujii<sup>1</sup>, Yoshihiko Ozaki<sup>1</sup>, Yoshihiro Okumura<sup>2</sup>

<sup>1</sup>DSP Technology,Co.,Ltd.   <sup>2</sup>RIKEN BSI

Why SATELLITE ?

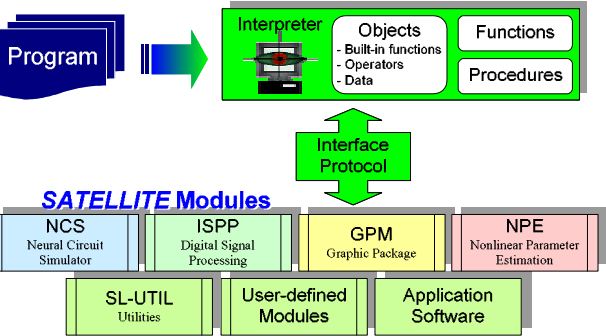
It is generally agreed that the biological system is one of the most complex and sophisticated mechanisms on the earth. However, in this moment, since there are few systematic theories for approaching such systems, trial and error studies based on knowledge of physiology, psychology, etc., has to continue. Environment to support and realize the ideas of scientists could be so important to advance the research. We assert that the establishment of **SATELLITE** (System Analysis Total Environment for Laboratory – Language and Interactive Execution) could be relevant.



**SATELLITE** consists of the **SATELLITE-shell** which provides interactive C-like language processing system, and several modules which together cover more than 200 commands (signal processing, numerical simulation, parameter estimation, etc.). The most important facility of **SATELLITE-shell** is an interactive operating environment. User can execute command sequences from the text file (batch processing) in case of the complex and large scale simulations. One can also visualize data and print it.

System

**SATELLITE** is an interpreter. Programs are translated into the intermediate stack code. The stack machine code is executed by stack machines. Therefore, the repetition procedures or functions, such as **for** and **while** commands, are performed at slightly higher speed.



**SATELLITE** organizes analysis techniques for various systems by Grouping its functions into modules, according to the purpose or method. There are several modules containing basic tools for system analysis, as listed below.

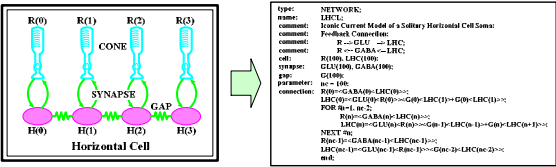
**ISPP** (Interactive **S**ignal **P**rocessing **P**ackage) is an important module of **SATELLITE**. Processing functions are represented by commands, that cover the methodology of the digital signal processing such as windowing, FFT, spectrum analysis by linear prediction models, filtering, etc. One can analyze data multilaterally using the signal processing and statistical techniques.

**GPM** (**G**raphic **P**ackage **M**odule) provides various graphic functions for making charts, contour maps, bird's-eye pictures, etc. The images can also be printed.

**NPE** (**N**onlinear **P**arameter **E**stimation) is a module to solve the problem of optimizing a target function using optimization algorithms, e.g., SIMPLEX, BFGS, Conjugate Gradient, etc. Useful tool for estimating model parameters from observed data without fundamental mathematical knowledge is also provided.

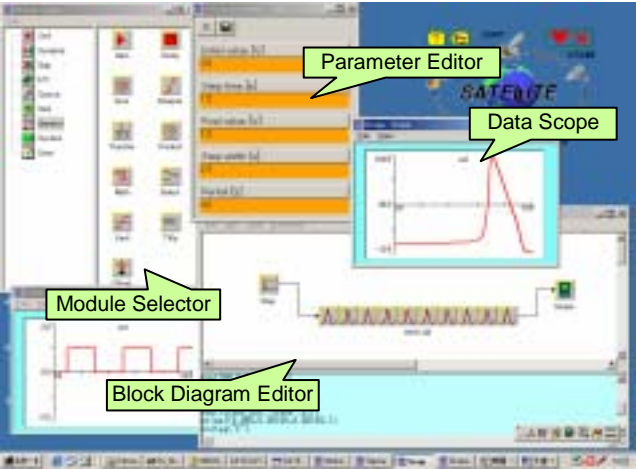
Modeling and Simulation

Information processing mechanism in the brain and the control nervous system is described mathematically based on the results of physiological experiments. Many of the mathematical models are described by nonlinear differential equations. The solutions are obtained numerically. In **NCS** (**N**eural **C**ircuits **S**imulator) module, characteristics or connecting states of cells are described using the exclusive model description language. It is possible to efficiently carry out the simulations under various conditions without rewriting the model description. In order to make **NCS** easier to use, the application which extended the function of **NCS** was created.



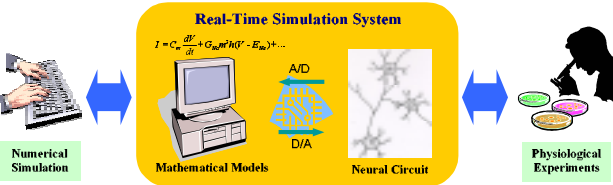
Modeling Tools

Large-scale and complex systems are often very difficult to write and debug. In **SATELLITE** you can use the block diagram editor. The editor includes all of the modeling flow control modules. Diagram can be saved and re-opened or exported as **NCS** model file.



Real-Time Simulation

Moreover, **NCS** module can perform real-time simulation through any I/O interface, with the precision of 1 millisecond (currently Microsoft Windows platform only). In future, we will develop a greater real-time simulation system which achieves the precision of 50 microseconds by using a machine with RT-Linux OS operated from GUI front end.



System Requirements

- Microsoft Windows:**
- Microsoft Windows 98 SE, Windows 2000 SP3 and higher
  - C++ compiler\* (Microsoft Visual C++ and Borland BCC compilers are supported)
- Apple Macintosh:**
- Mac OS X v.10.2 with XDarwin
  - C++ compiler\*
- Unix / Linux:**
- Hardware and Operating Systems:
    - Intel x86 : Linux 2.4 and higher based systems, FreeBSD 4.5 and higher
    - HP/Compaq Alpha 21x64 : Digital UNIX4.0D, Tru64 UNIX 5.0A
    - Others : The **SATELLITE** will run on most of the major platforms.
  - X Window System Ver.11 R6
  - C++ compiler\*
- \*notice: C++ compiler is necessary to use **NCS** and **NPE** modules.

Source code of **SATELLITE** will be released under BSD like license.  
See also <http://www.visionme.org/satellite/>