

# Visitor Research Report

**Visitor Name:** Mr. H. Camilo Rocha-Nino  
University of Illinois at Urbana-Champaign

**Area of Research:** Spacecraft Autonomy for In-Space Operations

**Period of Visit:** May 5, 2008 through June 13, 2008

## Goal:

Use Rewriting Logic (RL) to give an *executable formal semantics* of PLEXIL, a plan execution language developed by NASA for spacecraft automation.

## Strategy:

RL has been used extensively to formally study the semantics of languages. It offers a wide range of utilities by means of *Maude* and its formal analysis tools. We have used RL to specify the small-step semantics of PLEXIL and Maude to execute them. We have implemented the execution strategy of PLEXIL using Maude's *strategy language*.

## Accomplishments:

We have:

- Successfully implemented the desired semantics of PLEXIL in RL, being able to execute it using Maude and its strategy language.
- Elegantly simulated synchronous rewriting in Maude, a significant technical challenge in rewriting.
- Discovered, using our executable specification, several semantic issues in PLEXIL that are difficult to find using the PVS semantics such as termination and deadlocks.
- For those issues, we have proposed solutions that are begin considered by the PLEXIL developers.

## Future Work:

We consider that the following problems are worth or interesting to solve:

- Efficiency: we need to improve efficiency in order to execute complex plans. These are some alternatives (maybe complementary)
  - Write an extension of Maude for native synchronous rewriting
  - Try different ways of encoding the strategies
  - Wait for the release of the strategy language in Maude's core (currently available with Full Maude only)
  - Reduce the use of AC-matching

- Compiler: improve the compiler written in Maude so one can use a more flexible syntax
- Semantics: check if the condition *All children waiting or finished* or the action *Reset* are indeed necessary

**Pending Publications:**

We have agreed to write a technical report in the following months

**Seminar Presented:**

Title: Formal Executable Semantics of PLEXIL in Rewriting Logic

Date: June 12<sup>th</sup> of 2008