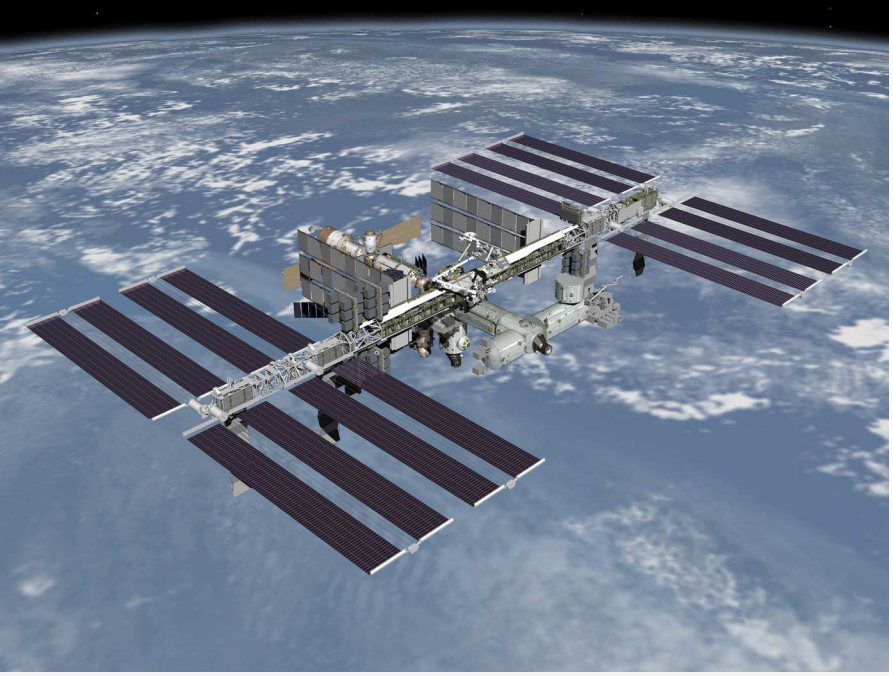


National Aeronautics and Space Administration

technology solution

Information Technology and Software

Hybrid Diagnostic Engine (HyDE) For Fault Analysis

Model-based diagnosis of hybrid systems

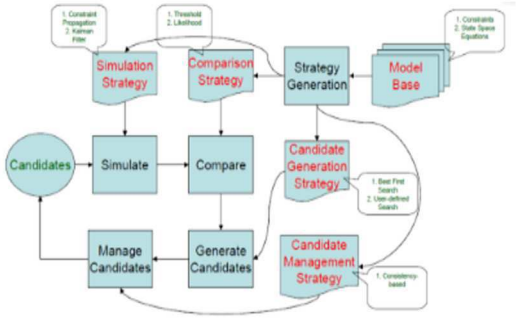
In recent years, several approaches have been proposed for model-based diagnosis of hybrid systems. These approaches deal with discrete or parametric faults, and perform consistency-based, stochastic or mixed reasoning. The major restriction that a diagnosis application designer faces is that each technique uses its own modeling paradigm and the reasoning algorithms implement a single strategy. Diagnosis application designers would like to have the flexibility of building models that are suitable for the task and choosing the strategies used in the diagnostic reasoning process. NASAs Hybrid Diagnostic Engine (HyDE) is a model-based diagnosis engine that provides a toolset for building a diagnostic application that uses models at different abstraction levels and the capability to mix and match reasoning approaches.

BENEFITS

- Model based Application developers only need to build models to work with HyDEs reasoning suite
- Fault coverage Diagnose single or multiple, simultaneous or sequential, persistent or intermittent faults
- Behavior coverage Handle qualitative and quantitative, static and dynamic, deterministic and probabilistic behavior
- Abstraction levels Diagnose at different levels of model abstraction from component to sub-system to system level

THE TECHNOLOGY

The models used by HyDE are similar to simulation models. They describe the expected behavior of the system under nominal and fault conditions. The model can be constructed in modular and hierarchical fashion and linked through shared variables/parameters. The component model is expressed as operating modes of the component and conditions for transitions between these various modes. Faults are modeled as transitions whose conditions for transitions are unknown. The behavior of the components is expressed as a set of variables/parameters and relations governing the interaction among them. Stochasticity is captured as probabilities associated with transitions, as well as noise, on the sensed variables. The HyDE architecture supports the use of multiple modeling paradigms at the component and system level. This approach is extensible, with support for the addition of new modeling paradigms as well as diagnostic reasoning algorithms for existing or new modeling paradigms. The key steps in the diagnostic reasoning include simulation, fault detection, conflict generation and candidate generation. Each of these steps forms a module and can be customized to the applications requirements including implementing new algorithms.



HyDE Architecture

APPLICATIONS

The technology has several potential applications:

- Electrical Power System
- Drilling Automation
- UAV diagnostics for FALCONSat5
- Organic Carbon Analyzer on board ISS
- Space missions

PUBLICATIONS

More Information

National Aeronautics and Space Administration

Technology Partnerships Office

Ames Research Center

MS 202A-3
Moffett Field, CA 94035
855-627-2249
ARC-TechTransfer@mail.nasa.gov

http://technology.nasa.gov/

www.nasa.gov

NP-2015-02-1460-HQ

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

ARC-15570-1