

**Intern Position Descriptions
Discovery & Systems Health Technical Area
NASA Ames Research Center**

Position 1: Numerical modeling of solid rocket motor physics

Priority: high

Potential funding source: ESMD ETDP

Requestor: Dogan Timucin

The physical modeling of a solid rocket motor involves a coupled formulation of chemical, thermal, structural, and fluid-dynamic processes, and the subsequent numerical solution of the resulting system of ODEs and PDEs to analyze transient and steady-state behaviors. The prospective candidate must have experience with numerical simulation of nonlinear phenomena in spatially extended stochastic dynamical systems. Strong background in standard numerical methods, especially integration of nonlinear hyperbolic PDEs, and proficiency with Matlab and C and/or Fortran are required. Prior experience with theory and simulation of solid rocket motors is highly desirable.

Position 2: Model-based diagnosis and prognosis

Priority: high

Potential funding source: ESMD ETDP

Requestor: Dogan Timucin

The health of an engineered system may often be described in a hybrid state space involving both discrete and continuous state variables. In practice, these variables are at best partially observed via sensor measurements, and techniques are needed to infer the health of the system as a whole from incomplete and noise-corrupted knowledge of the evolving state variables. Student will be involved in refining existing model-based diagnosis algorithms toward the development of an ISHM framework for hybrid nonlinear stochastic dynamical systems. Solid background in nonlinear dynamics, probability theory and stochastic processes, Bayesian decision and estimation theory, Kalman and particle filtering is required, as well as proficiency with Matlab and C++; familiarity with numerical optimization methods is a plus.

Position 3: Agents in air traffic management

Priority: high

Potential funding source: ARMD NGATS

Requestor: Kagan Tumer

Air traffic management is a challenging domain where a massively distributed system has to be coordinated in a dynamic and stochastic environment. This project investigates the application of learning agent technologies to the air traffic management problem. Student will be involved with early research, algorithm

development, and implementation. Experience with reinforcement learning and multi-agent systems is required, and familiarity with traffic management is a plus.

Position 4: Distributed mission health architectures

Priority: medium

Potential funding source: ARMD IVHM

Requestor: Kagan Tumer

In missions requiring distributed components to achieve a common goal, the system has to be configured in a way that ensures that degradation or outright failures of some components do not jeopardize the entire mission. This project explores distributed system/mission architectures to manage the system/mission health in a distributed and robust manner. Student will be involved with early research, algorithm development, and implementation. Experience with adaptive systems, multi-agent systems, and reinforcement learning is required and familiarity with Integrated System Health Management (ISHM) is a plus.

Position 5: Implementation and testing of Gaussian process regression

Priority: high

Potential funding source: ARMD IVHM

Requestor: Ashok Srivastava

A. Purpose of the Position

- The successful summer student will participate in the Intelligent Data Understanding group as a scientific programmer and will have the responsibility to develop, document, and test algorithms produced with members of the group. Application areas include Integrated Systems Health Management data sets from aeronautics and space systems. Knowledge of Matlab, C, C++, and principles of mathematical programming are desirable. Knowledge of Gaussian processes and a strong background in linear algebra are also highly desired.

B. Initial Duties

- Implementation and testing of Gaussian process regression and other suitable algorithms on Integrated Systems Health Management data sets.
- Documentation, implementation, and delivery of code.

C. Other Responsibilities

- Publication of a paper summarizing the results.

D. Knowledge and Skills Required

- An M.S. or Ph.D. degree in Computer Science, Electrical Engineering, or related field. Bachelor's degree with strong recommendations is also acceptable.
- Publication history in computer science or a related field.

- Ability to work effectively with senior scientific and management personnel.
- Strong interpersonal skills.

E. Suggested areas of knowledge and expertise

- Gaussian processes
- Aerospace systems
- Bayesian inference
- Optimization
- Signal processing