National Aeronautics and Space Administration

Materials Informatics Enables Rapid Materials Discovery

Machine Learning and Digital Thread Infrastructure: A force multiplier for the development of “fit-for-purpose” materials

Challenge

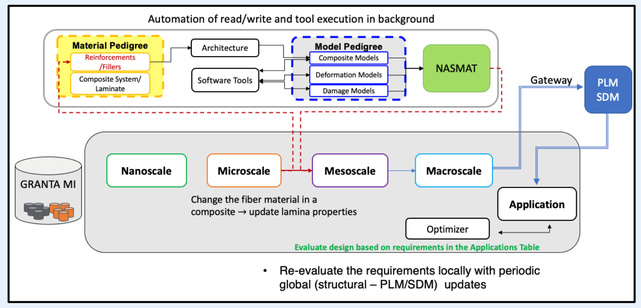
- Top performing organizations rate **New Materials** as one of **the most important** factors in meeting their innovation goals (Historically new materials ≥ 20 years)
- Need for faster, cheaper development of "fit-for-purpose" materials tailored to specific applications

Expected Impacts

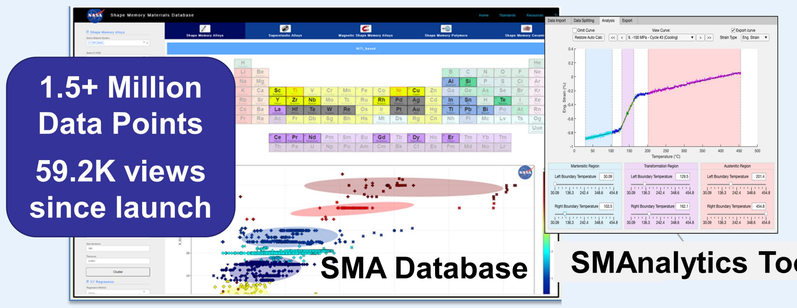
- Enable discovery of new materials for improved application performance
- Provide organizations with the framework for storing, managing, and disseminating large data sets for digital twin/thread maintenance
- Enable automation of information exchange between length scales to facilitate rapid, traceable multiscale simulations

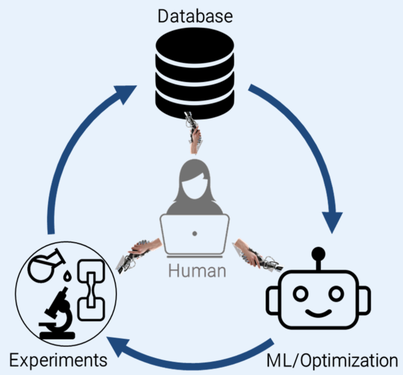
Solution

- Developing Machine Learning (ML) models for fast, consistent analysis of microstructures to enable discovery of process-property relationships
- Developed AIMAOS to orchestrates the Integrated Computational Materials Engineering (ICME) process by automatically updating and propagation analyses information across length scales
- Automated lab with artificial intelligence (AI)-generated experiments for high throughput experiments and discovery
- JARIMIS framework to connect data management, data analysis, AI/ML, and automated experiments



AIMAOS (Automatic Information Management Across Organizations and Scales)





J.A.R.I.M.I.S.
Just A Rather Intelligent Material Interrogation System

Results

Over **10,000 downloads** of MicroNet models for microstructure analysis. Over **50,000 views** to publicly available shape memory alloy (SMA) database and analytics tool. A robust schema and code to easily ingest and extract materials data from database

Next Steps

- Integrate automated lab from ChemSpeed into JARIMIS framework to rapidly develop high power electrical insulation materials for electrified aircraft
- Continue to develop MicroNet for additional image analysis tasks
- Connect AIMAOS with a driving optimization function to facilitate the design of ‘fit-for-purpose’ materials

Partners and Participants

- Boeing, General Electric Company, Ansys Granta MI, Materials Data Management, Inc.
- University of Massachusetts Lowell
- ASM International, OCAS
- NASA Glenn Research Center

IMAGINAVIATION

TRANSFORMATIONAL TOOLS & TECHNOLOGIES

POC: Steve Arnold, Brandon Hearley, and Joshua Stuckner - NASA Glenn Research Center