



AO Applied Optimization

The Right Balance of Non-Conformity & Critical Thinking

**3040 Presidential Dr. Ste. 100
Fairborn, OH 45324**



Who Is Applied Optimization (AO)?

Who We Are

- Since 1995, Applied Optimization, Inc. (AO) has been collaboratively discovering innovative solutions in material science and space science to address the technical challenges of our clients and partners in the industry and government
- Our mission is to work collaboratively and make a difference in a dynamic, rigorous environment where technical discovery is a daily pursuit
- We are open-minded listeners and adept at assessing and recognizing what value we might bring to create the optimum solution for your organization



Our Focus

We perform interdisciplinary research in the following areas:

- Applied and computational mathematics and modeling
- Additive manufacturing
- Algorithm development
- Astronomy
- Fluid dynamics
- Machine learning
- Mathematics and physics
- Material science
- Optical science and photonics
- Problem solving in pure sciences and engineering
- Scientific computations
- Structural mechanics



Our Five-Step Collaborative Process

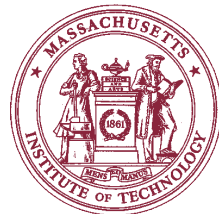
1. **Verity:** We believe the truth is knowable, trust in the law of causality—that every problem has a cause—and seek to find the root cause that will be the source of the solution
2. **Focus:** We identify the process within the process or separate “the wheat from the chaff”
3. **Timeliness:** We strive to meet all project deadlines and are mindful of resources
4. **Discovery:** We adopt an attitude of unbridled curiosity for every project to ensure no revolutionary insights are left undiscovered
5. **Solution:** We deliver solutions that can be implemented in a time of increasing threats and decreasing budgets



AO Senior Staff



Dr. Anil Chaudhary
*Computational mathematics
& manufacturing science*



Dr. Kimberly Kinateder
*Probabilistic learning &
mathematical modeling*





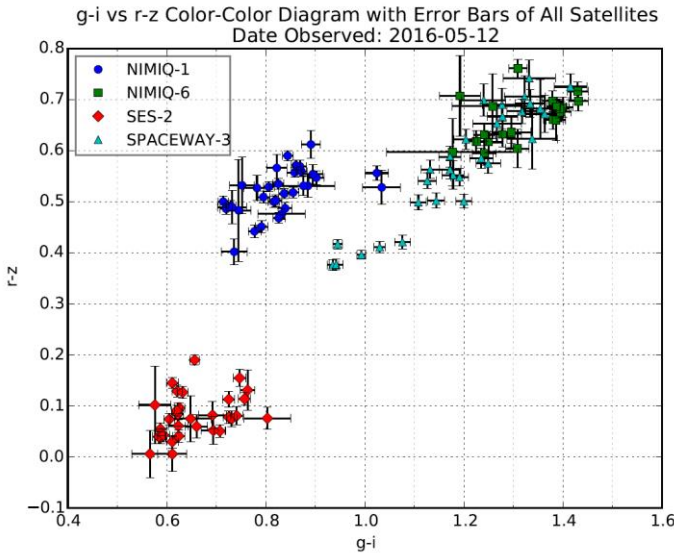
What Does AO Do?

What We Do

- We focus in space science, Additive Manufacturing (AM), Space Domain Awareness (SDA), optical engineering, and mathematical modeling
- We customize our technical solutions to customer needs to ensure specific answers for specific problems
- Our innovative solutions are designed to provide results when used in a client's day-to-day processes



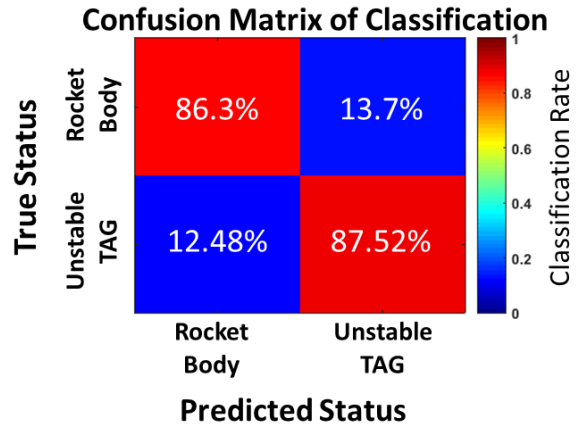
Space Science



$$P(r) = \frac{EL}{r^2} O(r) [\beta_{aer}(r) + \beta_{mol}(r)] e^{-2 \int_0^S \alpha_{aer}(s) + \alpha_{mol}(s) ds} \quad \text{Lidar Equation}$$

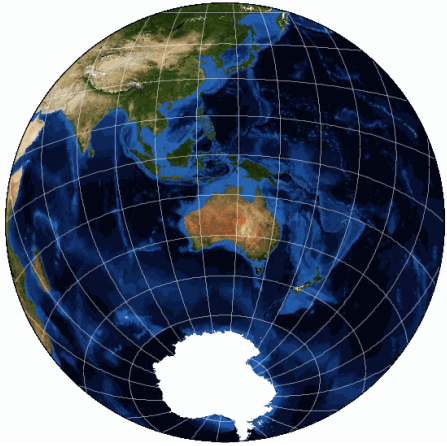
$$\pi \frac{|RS|^2 |OR|^2}{|AU|^2} 10^{\frac{m_{SUN} - m_{RSO}}{2.5}} [m^2] = aA_P \cos(\omega) \cos(\theta) + aA_B \cos(\psi) \cos(\eta) [m^2] \quad \text{Albedo-Area}$$

$$m_{standard} = m_{inst} + m_{first-order_ext} + m_{second-order_ext} + m_{zp} + m_{ct} \quad \text{Standard Magnitude}$$



AO's space team works in the areas of:

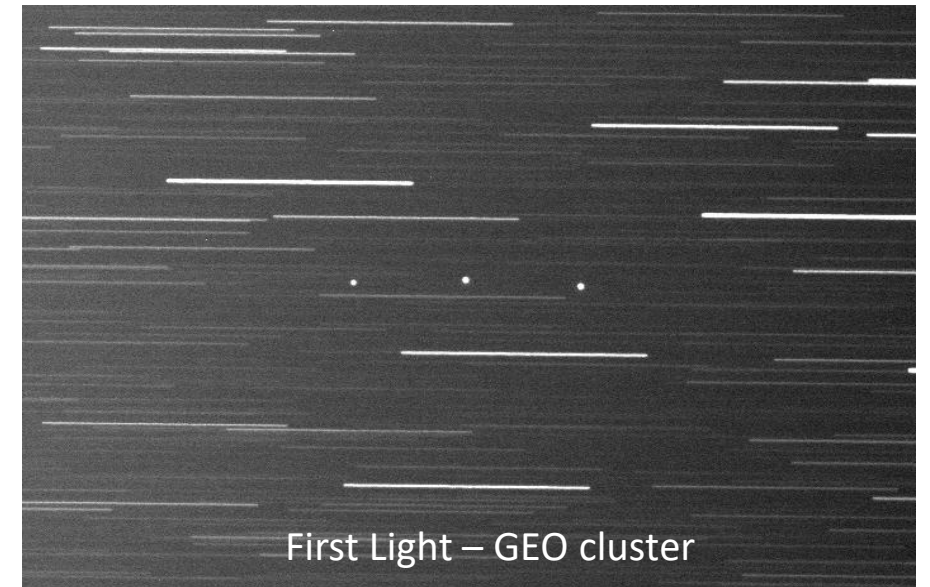
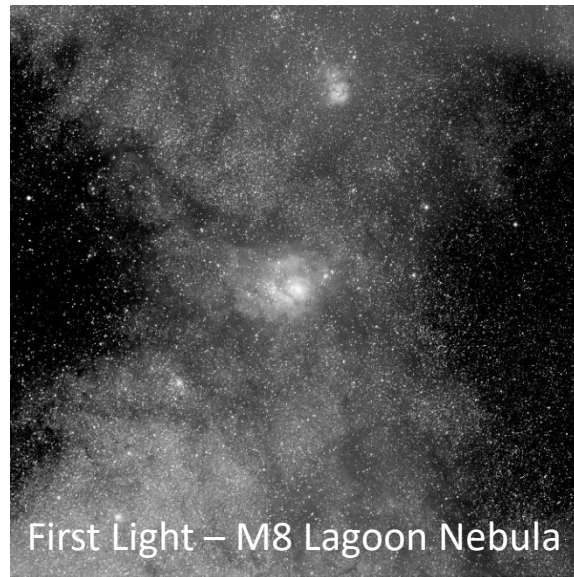
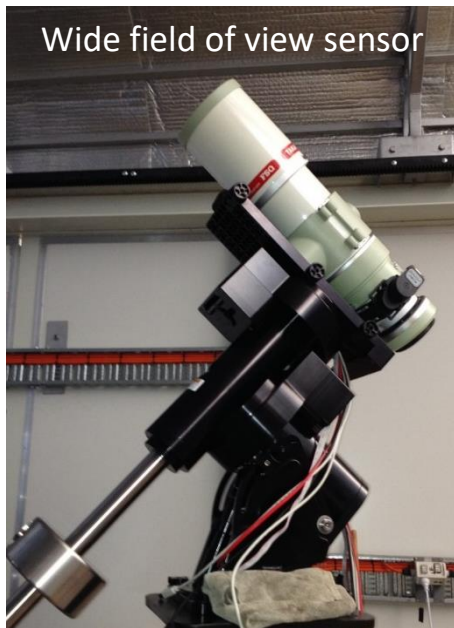
- SDA
- Algorithm development for electro-optical data collections and calibrations
- Algorithm development for exploitation
- Electro-optical sensor development and testing
- Optical design and implementation of novel imaging devices



Space Object Characterization

AO's small commercial-off-the-shelf telescope in western Australia supports our SDA projects:

- Research and development in space object characterization using spatially non-resolved, multi-spectral photometry
- Automated tracking of deep space objects



Atmospheric Turbulence Research



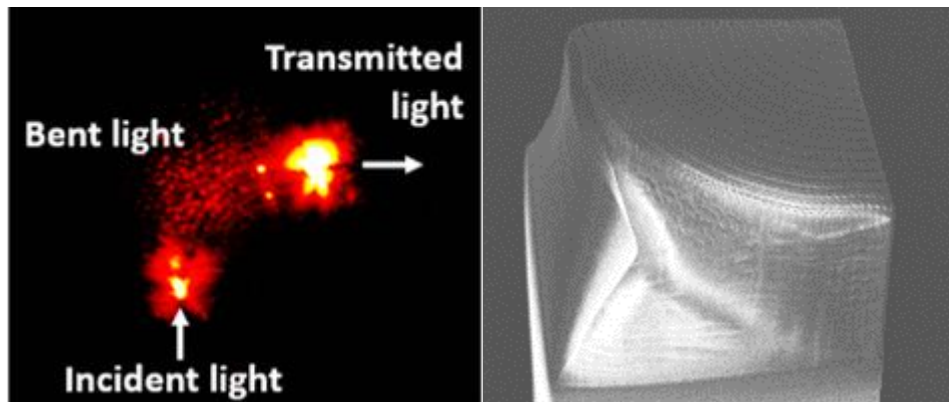
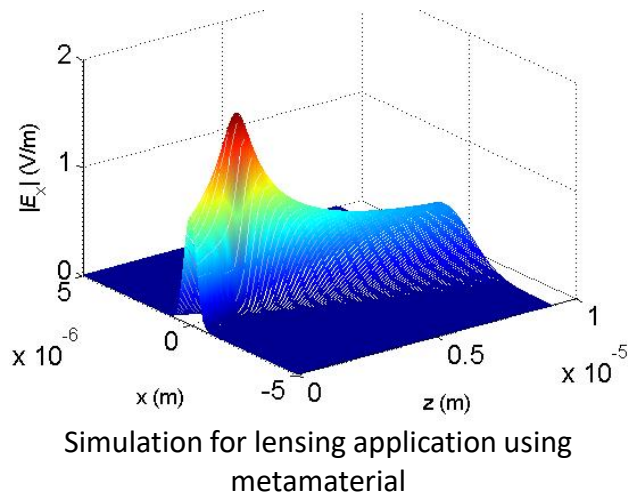
AO operates a telescope and laser facility in Yellow Springs, Ohio:

- Research and development in atmospheric turbulence
- Automated closed-loop tracking of Earth-orbiting space objects
- Photometry for spatially non-resolved object characterization
- Research and development in stereo observations
- Collaboration in joint sensor technology testing and exercises

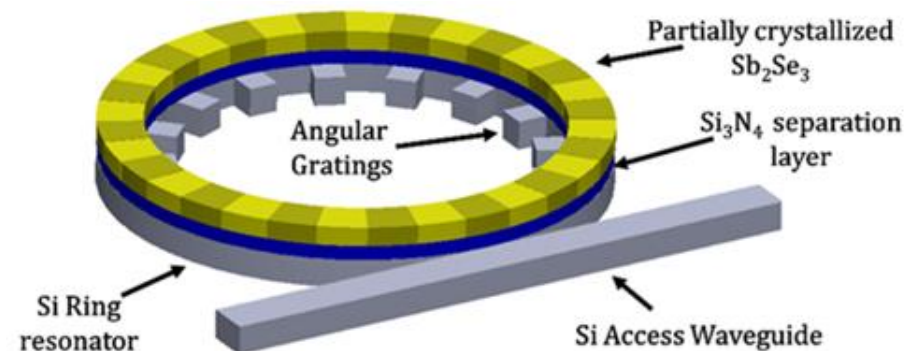
Electro-Optics and Photonics

AO's optical science team works in the areas of:

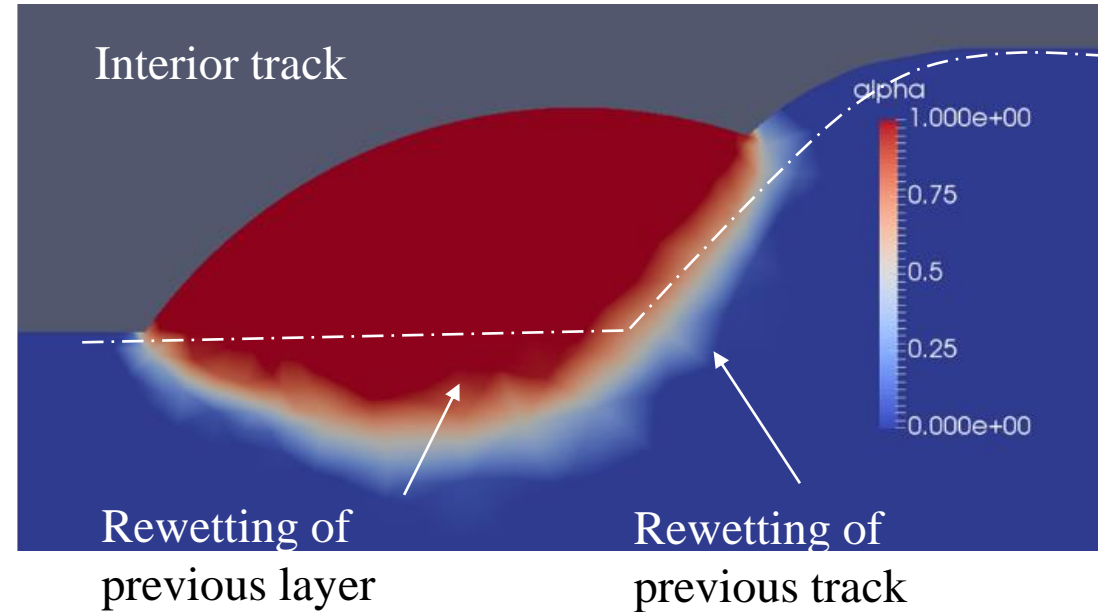
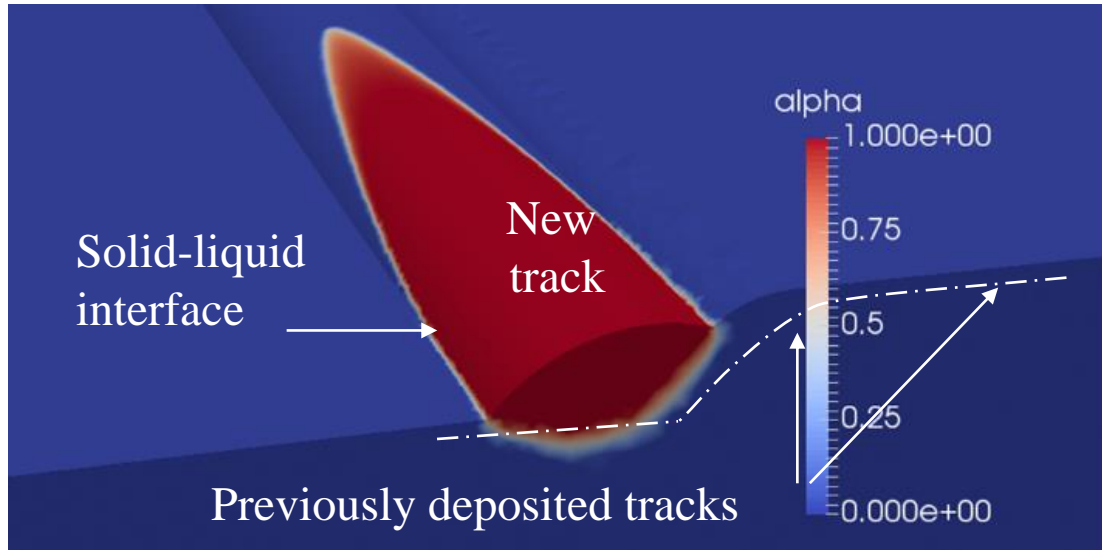
- **Metamaterials** - applications include beam shaping, tunable optical filters, and superlenses
- **Singular optics** – developing a photonic integrated circuit, or transceiver, capable of sending and receiving signals through free space in a secured wireless communication system
- **Novel photonic devices** - developing periodic nanostructures for beam tuning and multiplexing applications
- **Simulations and modeling** - developing an algorithm to predict optical properties through a periodic metamaterial and photonic crystal structures
- **Prototypes** - developing transceivers, photonic crystals, and optical filters



Photonic crystal



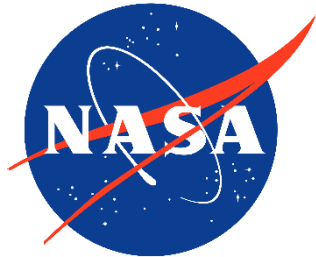
Additive Manufacturing (AM)



AO's AM team works in the following areas:

- Research and development in metallurgy and metals processing
- Melt-pool thermal-computation fluid dynamics
- Distortion prediction and thermal cycling
- Prediction of solidification parameters and grain structure
- Development and maintenance of AO commercial software packages

Who We Serve



Government

- Air Force Academy
- Air Force Research Laboratory
- NASA
- NASIC
- US Air Force
- US Space Force
- US Navy



Industry

- America Makes
- NIST





3D SYSTEMS®



ALTAMIRA



America Makes

ELEMENTUM®



LOCKHEED MARTIN 

Strategic Partners

- 3D Systems
- Altamira
- America Makes
- Elementum 3D
- Lockheed Martin
- Materion
- Pilgrim Consulting LLC
- Rolls-Royce
- The Pennsylvania State University
- TYTO Athene, LLC
- University of Dayton



MATERION



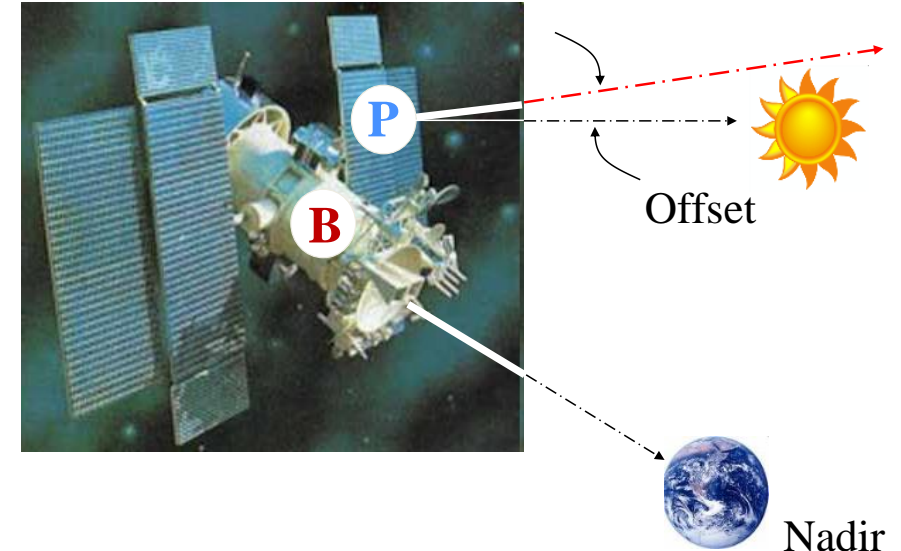
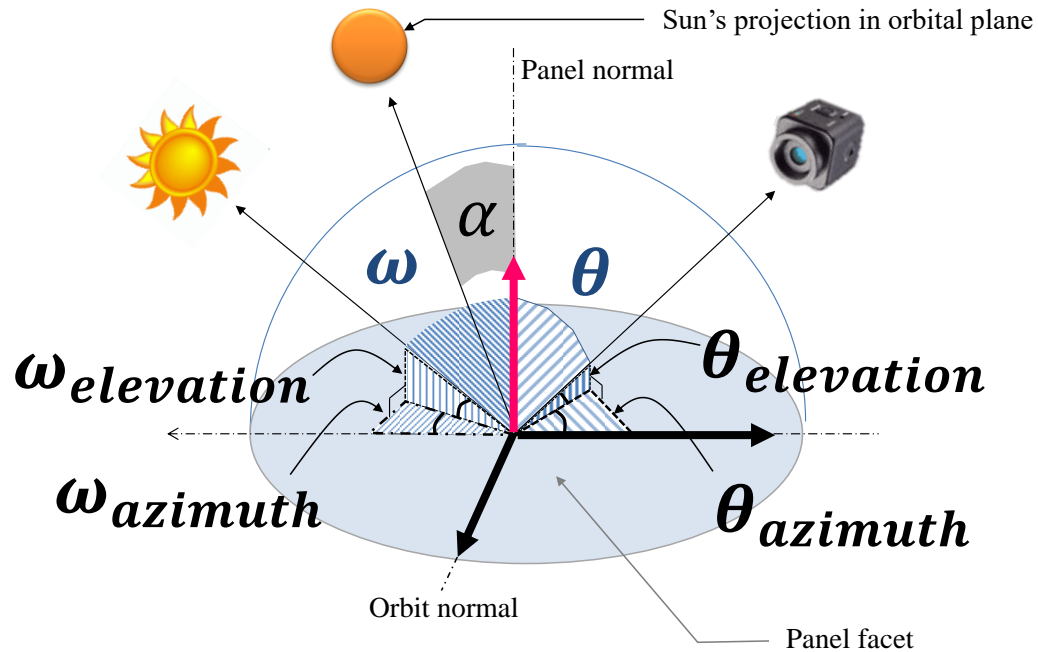
University of Dayton





AO's Products

Inversion of Photometry Signatures (RAD tool)



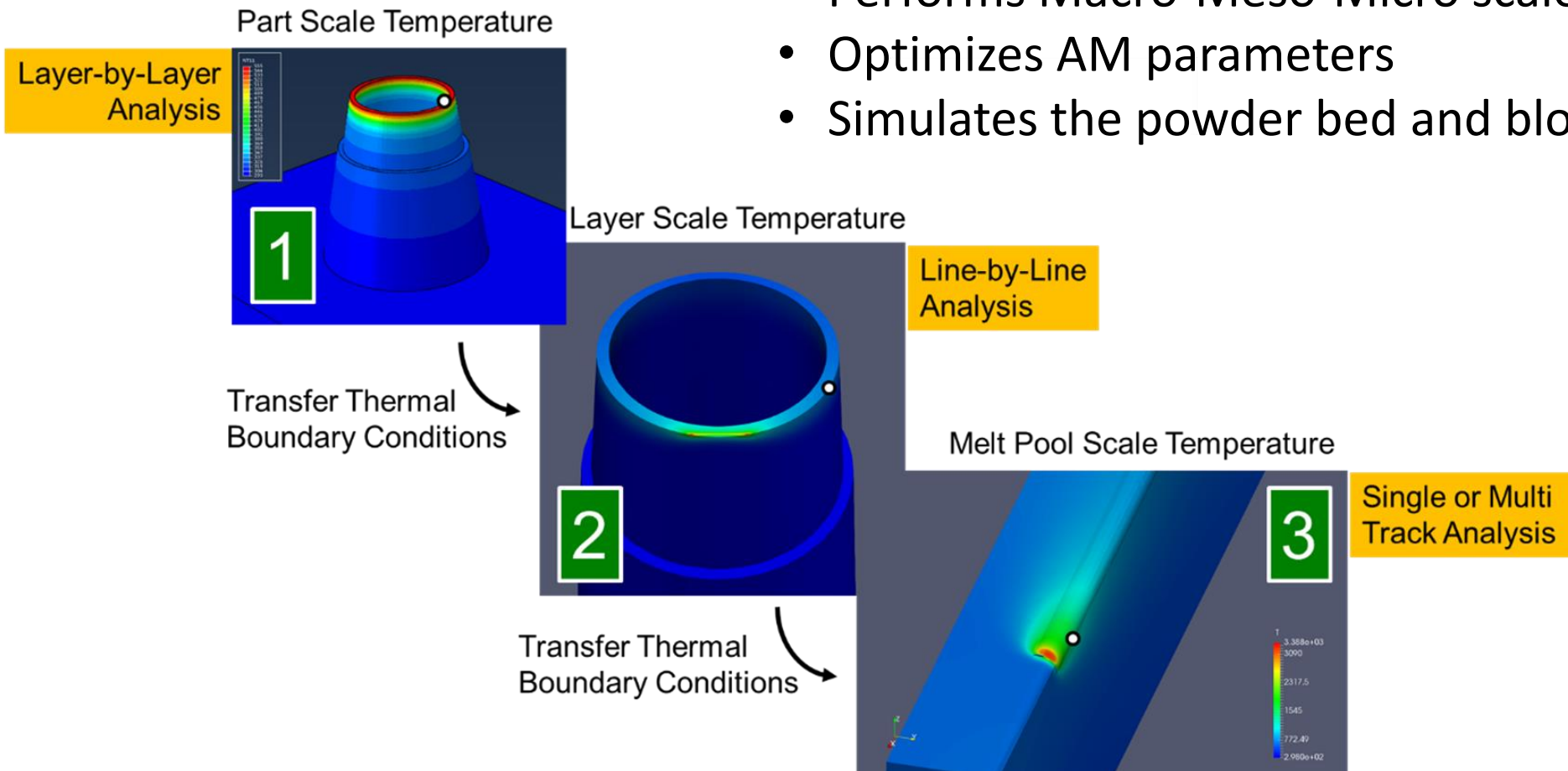
Software to extract satellite body and solar panel characteristics from spatially non-resolved data:

- Solves albedo-area products of the body and solar panels
- Estimates solar panel pointing angle offset from the sun
- Performs change detection using photometric brightness data
- Applicable to data collected by ground and space-based sensors

Additive Manufacturing Parameter Predictor (AMP²)

Multi-scale, multi-physics software for AM:

- Integrated Computational Materials Engineering (ICME)
- Performs Macro-Meso-Micro scale analysis
- Optimizes AM parameters
- Simulates the powder bed and blown powder process





Join the Team!

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- We are seeking hardworking, organized, and positive candidates to join our team
- Our work environment allows candidates to apply their academic knowledge in daily pursuit of technical discovery and change
- We have employed students and graduates from local learning institutions such as Cedarville University, Miami University, Ohio State University, University of Dayton, and Wright State University
- Our undergraduate and graduate interns sharpen their skills, take on responsibilities, and help further the fields of AM and space science while developing as professionals
- Dayton, Ohio, is a great place to live and work





Contact Us

Give Us a Call!

We welcome inquiries relating to AO or career opportunities!

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