ARTIFICIAL INTELLIGENCE IN COMPOSITES

As Artificial Intelligence (AI) capabilities continue to expand, the University of Delaware Center for Composite Materials (UD-CCM) is proactively exploring ways to leverage this potential within the realm of composites. UD-CCM researchers are using AI to efficiently advance composite manufacturing processes and materials innovation as well as develop cutting-edge technology with multifunction applications. Ongoing research focuses specifically on AI-powered inverse composite design and wearable nanocomposite sensor technology.

AI-Powered Inverse Design

UD-CCM is developing a comprehensive AI-enabled inverse design method because the trial-and-error testing traditionally used to optimize composite materials development and manufacturing processes is inefficient and costly. The research approaches this goal through three separate yet interrelated thrusts:

- Developing a "Digital Life Cycle" (DLC) that models the material-process-microstructure-performance (MP2) relationship throughout all stages of composite components' lifecycles
- Creating new AI models that can efficiently map composite materials' architectures and manufacturing processes to enable inverse design capabilities
- Informing and validating the DLC and AI models through innovative experimentation

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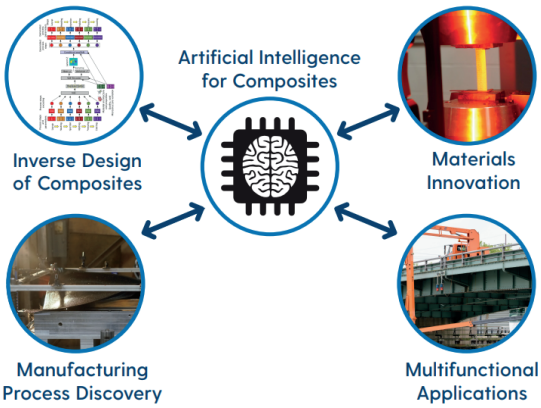
Nanocomposite Sensors

UD-CCM is also developing AI-enabled wearable sensor technology. Researchers have created knee sleeve sensors that measure patients' strength, range of motion, and mobility by depositing a porous nanocomposite coating of functionalized carbon nanotubes on commercially available textiles.

AI models can use this data to create easy-to-interpret visualizations that help clinicians track patient progress and compliance, allowing them to optimize treatment plans. Ongoing research for this project focuses on testing sensor durability, exploring the processing technique's scalability, and using machine learning algorithms to detect gait patterns.

While this study focuses on monitoring knee-related rehabilitation progress, its findings could be applied to a broader range of health and infrastructure monitoring technologies.



CCM's AI-related research areas

Patented nanocomposite sensor with integrated AI-enabled data analytics for physical rehabilitation

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