CIbM
Center for Innovation-based Manufacturing

VirginiaTech
Invent the Future

An ICTAS Center

www.cibm.ise.vt.edu

The Need for an Innovation-based Manufacturing Center

In the last decades, the North American manufacturing sector has been continuously challenged by competition from low labor cost countries. Once a product reaches a certain level of maturity, it quickly becomes a commodity that can be produced in any part of the world at minimum cost. In order to remain competitive, manufacturers are in urgent need to bring innovation to their day to day operations both in terms of new products as well as new processes and technologies. These new market conditions are increasing the pressure for the development of new innovation principles specifically designed for manufacturers. The type of innovation tools should focus on dramatically improving the efficiency of current manufacturing processes but also enhance the manufacturability of lab tested technologies for which there are usually not known manufacturing processes at production scale, thus limiting their commercialization potential. This new economic scenario demands for fundamental research in innovation based manufacturing which we define as a new way of doing manufacturing. This shift may consist of incremental or radical changes in the way we use machines, tools and people to make things for sale on a large scale and at a reasonable cost.

The primary goals of innovation-based manufacturing are (i) to boost the commercialization potential of basic research that is currently constrained by the lack of adequate processes and systems and (ii) to improve current manufacturing processes by incremental changes or revolutionary new approaches. In order to achieve these goals, new pedagogical research in innovation principles, related specifically to manufacturing, is needed. The proposed center will focus on the development of new innovation methodologies and their application to challenging manufacturability problems across multiple areas such as renewable energies, micro- and nano-manufacturing, medical devices, etc. In addition, CIbM will actively work on the definition of the manufacturing concepts of the future.

Manufacturing Solutions
- Collaborate with industrial partners
- Provide solutions for issues in existing manufacturing technologies.
- Train manufacturing leaders in innovative problem solving

Manufacturability of New Technologies
- Bridge the gap between basic research and commercialization.
- Prototype scalable processes and systems for emerging technologies.

Redefining Manufacturing
- Identify disruptive technologies
- Perform transformative research in manufacturing
- Integrate external technologies into manufacturing applications.

Innovation-based Manufacturing Fundamentals
Build a foundation for manufacturing-specific innovation principles and research new methodologies for innovative technology development.

The overall goal of CIbM is to develop new innovation methodologies to solve challenging manufacturing problems across multiple areas.

Vision

The vision of the center is to be recognized as a pioneer in manufacturing innovation, using a radically different cross functional approach to bridge the gap between conceptual design and producible goods.

Mission

The mission of the center is to create a foundation for innovation in manufacturing systems aiming at accelerating the commercial development of innovative technologies and advancing the United States manufacturing infrastructure by applying innovative methods while training the next generation of manufacturing leaders.

Contact Information

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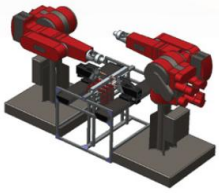
Current Research Projects

Development of Scalable Manufacturing Systems for Renewable Energy Technologies

Virginia Tech researchers successfully developed the first stable bio-oil from woody feedstock. However, a larger scale demonstration of the system outside the laboratory requires the development of a complete manufacturing system. CIbM will concentrate on process design, process scalability, facility layout, and material, people and information flow design. The main focus will be to enable and accelerate the technology from prototype to mass production.

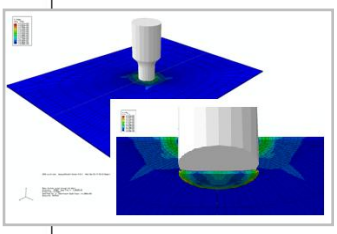
Implementation of Self-Healing Approach for Smart Assembly Systems



A significant characteristic of future manufacturing systems will be the ability to autonomously correct for faults or apply compensation actions during the assembly process. These systems will not only improve the quality of products, but indirectly lower scrap rates and increase productions efficiencies. Our current research focuses on integrating state-of-the-art sensor-actuator networks to replicate the assembly of compliant or flexible parts for closed-loop control in spot welding.

Additive Manufacturing for Cost-Effective Production of Custom Products

Bicycle helmets remain the most effective safety device available to reduce head injury and death from bicycle crashes. However, for a helmet to be useful, it must be positioned properly and fit securely on the rider's head. To address this issue, research is being conducted into the manufacture of custom fitting bicycle helmet liners using additive manufacturing technologies as a cost-efficient alternative manufacturing technique.



Stress Analysis of Aluminum Punching Operations

Compliance with tighter emission regulations has increased the proportion of parasitic weight in commercial vehicles. While significant weight reductions can be achieved by substituting steel components with high strength aluminum parts, a re-design of vehicle components is necessary to maintain the overall design and safety performance of the vehicles. Working with an industrial partner, CIbM is developing reliable process models to be used with complex geometries for finite element analyses.

Guided Cross-Functional and Collaborative Problem-Solving

Building successful problem solving teams can easily become a hit-or-miss game. In addition, the way the problem is defined, potential solutions are selected and then pursued has a detrimental effect on the solution quality and time needed to solve the problem. Our current research focuses on a myriad of factors influencing the problem solving process, as well as the sources used for the gathering of information. In our problem-solving sessions, participants have access to the internet and build solutions for previously unfamiliar application in a collaborative and cross-functional environment.

Additional Key Personnel

Foster Agblevor
Biological Systems Engineering

Deborah Cook
Business Information Systems

Tom Campbell
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Kimberly Ellis
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Engineering Education

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