MIT Industrial Liaison Program Faculty Knowledgebase Report

COVID-19 and Manufacturing: Digital Twins

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Digital Twins: The Vision. And Demystified.
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Dr. Anthony is an expert in designing instruments and techniques to monitor, measure, and control complex physical systems. His work integrates mechanical, electrical, and optical engineering with computer science and optimization to deliver innovative solutions across various manufacturing industries.

The core of Dr. Anthony's research lies in *computational instrumentation*—the development of tools and methods to monitor and control intricate systems in fields like manufacturing and medical diagnostics. His work includes creating advanced measurement and instrumentation solutions for both manufacturing systems and medical imaging technologies.

Beyond academia, Dr. Anthony brings extensive experience in technology innovation, product realization, and business entrepreneurship, particularly at the convergence of information technology and advanced manufacturing. He has over 25 years of experience driving market-driven technology solutions from concept to commercialization. His achievements include winning an Emmy Award from the Academy of Television Arts and Sciences for broadcast technical innovation.

In the classroom, Dr. Anthony focuses on teaching the modeling of large-scale systems for decision-making across various domains. He is also deeply involved in developing optimization algorithms and software for analyzing and designing these systems. His dual experience in academia and industry positions him as a leader in translating cutting-edge research into practical, impactful technologies.

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The Vision: With the proliferation of digital technologies and a rapidly changing global market, manufacturing paradigms will shift from automated to autonomous operations with more flexible flow chains. This in turn enables a more rapid realization of products from concepts in commercially viable ways, shorter time to market and faster throughput.

The digital thread of sensors, data, computation, and information is required to fully realize the potential of digitally-native production systems, with high-value, customized, products. The digitally native production system includes digital twins of the product, materials, manufacturing process, supply chain and production line.

A full framework of digital twins assist in simulating and integrating sensor data for data analytics. Digital twins enable greater throughput, early identification of bottleneck processes, supply chain issues and identification of novel process and production level opportunities.

And Demystified: Digital twins are, simply, physics-based and data driven models. They are design and decision tools. Let's explore some examples.