Digital Manufacturing: Recent Developments

William P. King, Ph.D.
Chief Technology Officer, Digital Manufacturing and Design Innovation Institute
Ralph A. Andersen Endowed Chair, Department of Mechanical Science and Engineering, University of Illinois Urbana-Champaign
Wpk@illinois.edu

Digital connections to physical industrial assets will drive the next wave of innovation for the global economy. The system of connected industrial assets is sometimes referred to as the industrial internet, or in Europe it is known as Industrie 4.0. Within the manufacturing sector, it is referred to as digital manufacturing.

Manufactured products generate data in every phase of their lifecycle. Data is generated during design, sourcing, production, distribution, point of sale, and when the product is in use. In fact, manufacturing generates more data than any other sector of the economy. Remarkably the amount of data in manufacturing significantly exceeds the amount of data generated in banking and finance, healthcare, retail, or entertainment. Today, only a small fraction of the data generated in manufacturing is used. There is a lack of technologies that aggregate and use manufacturing data. The proposed solution to this problem is the *digital thread*, which is the seamless flow of data across the product lifecycle, and the information systems that manage and use this data. Data analytics on the digital thread data may create significant reductions in the time and cost to design and manufacture a physical product.

The Digital Manufacturing and Design Innovation Institute (DMDII) is a $320M private-public partnership, located in Chicago, IL. This partnership has significant investments from the world's best manufacturing companies, including GE, Siemens, Boeing, Caterpillar, and P&G. The Chicago region is one of the most powerful manufacturing centers in the world, with more than $1T of annual manufacturing output, and thousands of small manufacturing businesses. DMDII's mission is to transform manufacturing by bringing digital tools to market that dramatically reduce the time and cost of manufacturing complex products.

The biggest opportunity for digital manufacturing impact is to create links between designers and makers. Designers are the people that create a product concept and determine all of its features including size, shape, and material composition. The designer is responsible for ensuring that all of the product features support the product performance and create a particular set of benefits to the end user. Makers are the people that turn this set of feature specifications into a physical thing. Today, there is very little connectedness between designers and makers. This lack of connectedness leads to slow product development times, and high labor content during prototyping and manufacturing scale-up.

There are many other opportunities for impact, for example data analytics that can optimize factory operations for increased equipment utilization, reduced energy

consumption, or increased product quality. Another example is supply network management tools, where a factory manager can view all of the raw materials and manufactured parts flowing through a supply network, and use this information to schedule factory operations and product deliveries. Finally, one of the exiting value creation opportunities is for smart, connected products that can send customer experience data back to a product manager. This data can drive new types of demand sensing, and can inform the designs of future products.

This talk will describe the portfolio of technology projects underway at DMDII, and how others can engage with DMDII.