THE PROMISE OF A NEW ERA

The influence of the Manufacturing Engineering Division on Industry neXt.

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Convergence of digital technologies and data from processes, software systems, predictive models, as well as people has revolutionized manufacturing and manufacturing systems over the decades. This knowledge-enabled vision, which many have shared in the past few decades, is built upon a broad base of the understanding of the fundamental behaviors of process physics, and methods by which data can be converted to information and information to knowledge through modeling, and a concurrent quantification of uncertainty.

This convergence has many descriptive terms, but the most representative in my view is “Industry neXt,” which represents the movement into the next evolution of manufacturing at the crossovers of disparate yet convergent scientific, engineering, and social disciplines. As the ASME Manufacturing Engineering Division (MED; formerly the Machine Shop Division, then Production Engineering Division) reaches its 100-year milestone this year, the influence of its members on the collective body of knowledge supporting the Industry neXt transformation should be acknowledged. Early efforts comprised empirical studies of machining techniques resulting in rules and guidelines promulgated through books, such as ASME member Frederick Halsey’s original Handbook for Machine Designers, Shop Men and Draftsmen, published in 1916. Such efforts reflect the spirit of ASME MED to be not only a group to derive knowledge, but also to bring that knowledge to the people that need it.

As MED grew, so did the range of knowledge generation. Previous chairs of the division contributed to fields beyond metalcutting such as grinding, resultant stresses and conditions of materials, tooling and fixturing, material handling, metrology and gauging, dynamic tooling and fixturing, material handling, and accurate understanding of the effect of plant, or entire manufacturing enterprise.

Perhaps the most fascinating aspect of this evolution is the discovery of hidden information from patterns that researchers and engineers have been able to extract from data to inform manufacturing networks. In addition to the advance- ments in sensor development, vision systems, and noise rejection and estimation methods, the concept of sensor fusion has given value of the generated data as a whole that exceeds that of the sum of the individual sources. Information is being gathered “between the lines” of individual sensing paradigms, better aligning the information of the outside world with natural perception.

The progress in automation, control and robotics has also influenced the Industry neXt revolution. MED members study and deploy open-architecture control systems such as the Robotic Operating System (ROS) in innumerable applications, to automate previously manual processes such as bin picking, part delivery, simple assembly tasks, and a variety of collaborative robot (cobot) applications.

A paramount area that we look forward to celebrating and better understanding as we move to the new century of MED is the role of people in manufacturing. Humans are differentiated from all other living beings and machines by the ability to envision that which does not yet exist, training for the industries, 1927, and even the need for diverse perspectives in manufacturing with his century-old article “Employment of Women in Our Industries.” [American Machinist, vol. 48, 1918].

A later MED chair, Daniel Koenig, researched extensively into relationships among maintenance practices, employee management strategies and quality through an extensive publication record. This understanding of the nature of manufacturing as a business of people is foundational to the future as artificial intelligence and decision systems are developing and finding their way into the manufacturing enterprise.

Today, as we look back to survey the beginnings of the Industry neXt manufacturing revolution and forward to the obvious technological leaps to follow, we can also see how the advancements in smart manufacturing are carrying over to other industries, and also being informed by them.

A closely aligned and complementary industry is transportation, where the most recent innovations have been in automated driving. As vehicles move through a network, so do parts between them. Research will continue turning toward understanding and redefining the role of the associate on the production line, the operations manager, the engineer, and product and process designers.

It is important to understand the physics of the way a process behaves, but the influence of people’s decisions and actions on how the process performs is also important to quantify. Even our first MED chairperson, W.A. Viall, considered learning and the building of collective intelligence around manufacturing by questioning “Has the Need for Apprenticeship Passed?” [ASME, Education and Training, 1986].

Understanding manufacturing as a business of people is foundational to the future.