New Challenges for Developing and Implementing Sustainability Principles for Next Generation Manufacturing

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ABSTRACT

This presentation will begin by giving a historical perspective, showing the evolution of principles and practices from lean to green to sustainable manufacturing, and will then present the new challenges for next generation manufacturing that require sustainability principles for product and process innovation to enable economic development, environmental protection and societal benefits. The presentation of these principles will also discuss total life-cycle considerations in product design and manufacture covering the effects of four life-cycle stages (pre-manufacturing, manufacturing, use and post-use). The presentation will show that innovation-based sustainable manufacturing must be based on the transformation of the traditional 3Rs (reduce, reuse and recycle) concepts into 6Rs (reduce, reuse, recycle, recover, redesign, remanufacture). Societal, environmental and economic benefits of implementing sustainable product design and manufacturing will be highlighted. A summary of product and process sustainability assessment methodologies will be presented, drawn from recent case studies covering: (a) sustainability evaluation in machining processes; (b) sustainability scoring method in a consumer electronic product – laser printer; and (c) sustainability analysis in autobody design and manufacture using a total life-cycle evaluation. Finally, national and international trends in sustainable manufacturing research and applications will be outlined and scientific and technological challenges for the future will be summarized.

BIO

Dr. I.S. Jawahir is a Professor of Mechanical Engineering (since July 1996), and James F. Hardymon Endowed Chair in Manufacturing Systems (since July 2002) at the University of Kentucky (Lexington, KY, USA), and the Chairman of the Technical Area of Manufacturing in the Department of Mechanical Engineering. He received his Ph.D. from the University of New South Wales (Sydney, Australia) in 1986. Dr. Jawahir has been active in the area of machining processes for over three decades, has published over 180 research papers in refereed journals and conference proceedings, and has been awarded 4 U.S. patents. He has directed the research of 18 PhD and 54 MS graduates. His current research interests are: modeling and optimization of machining operations, product design for sustainability, and sustainable manufacturing. During the last eighteen years at the University of Kentucky, he has received significant research funding from major industrial groups including Toyota, General Motors, Ford, and from U.S. Government agencies such as NSF, Department of Education and DoD. Dr. Jawahir is a Fellow of CIRP (The International Academy for Production Engineering) and ASME, and a Member of SME. He is the Technical Editor of the Journal of Machining Science and Technology. He is a Member and the Vice Chair of the ASME Board for Research and Technology Development (BRTD). He is also the Chairman of the ASME Research Committee on “Sustainable Products and Processes.” In 2007, he became the Founding Editor-in-Chief of the International Journal of Sustainable Manufacturing. He has delivered keynote addresses in 18 major international conferences, and over 70 invited presentations in 25 countries.