EDITORIAL

Is the Sound and Vibration World Flat or Just Less Round?

***Raj Singh**, Contributing Editor*

Globalization, outsourcing of jobs, and cost reduction (for products and services) seem to be major topics of discussion and anecdotal stories when I interact with my colleagues in industry and academia and my students. Well, why should an academic like me discuss this issue or even worry about the effects of a rapidly shrinking world? Globalization affects us all and we need to prepare ourselves and future generations to best cope with it. Some of our students (in the U.S. and elsewhere) are already ahead of the teachers, since they are trying to outsource their homework, laboratory reports, and term paper assignments!

Perhaps the entire issue has been best described, within political and socioeconomic contexts, by *New York Times* columnist Thomas L. Friedman in his latest best-seller, *The World is Flat*. (Go to your favorite virtual or brick-and-mortar bookstore or library for a copy to read.) I will borrow the idea of 'flatness' from Friedman and pose the following question – Is the world of sound and vibration flat? Or just less round? Perhaps an ellipsoid? My invitation to participate in this discourse is framed in a series of questions, many of which defy easy and quick answers. In the best tradition of academicians, I have used this Socratic method to great effect in teaching for more than a quarter of a century. (Yes, I am getting older but not senile unlike some of my colleagues.)

Could we define the "flatness level" (similar to the "coefficient of flatness" as stated by Friedman) of a nation or a profession (like our own)? According to Friedman, the "ideal country" in a flat world "tries to tap the energy, entrepreneurship, creativity, and intelligence of their people." In our profession, flatness could be defined by the extent to which noise and vibration engineering work could be commoditized (like the manufacturing of parts) and done anywhere in the world. Using geometry (as engineers are trained to think), the degree of flatness could be defined by the deviation from the round world or by the curvature from the finite value of a sphere to infinite for a flat surface. We should also recognize that we would have used a logarithmic scale, since some countries are well prepared to handle work (say noise and vibration testing or services) from other nations, whose engineers would have not had any formal training. Thus we could define the flatness on a dB basis (now that is a term that sound and vibration engineers understand). But what would be the reference quantity for flatness? The extreme limit in terms of geometry would of course be the infinite curvature (for a flat surface).

Should multinational corporations export research and laboratory facilities to faraway places without regard to engineering capabilities and expertise? Have the goods and services produced by the sound and vibration world (including equipment, software codes and services) become commodotized? Can companies easily transport: engineering services; finite and boundary element, multibody dynamics, and modal analysis codes; and laboratory facilities to nations with low-cost labor and less onerous labor and environmental laws? Are sound and vibration experts, computer-aided engineering (CAE) analysts, data acquisition engineers, and the like in developing nations equipped well enough to address such issues without any specialized or advanced training or research background? For example, an Indian software company recently sent me an e-mail message requesting copies of my extensive course notes (in electronic form, free of charge, of course) to provide them to their clients.

Elsewhere, some of our CAE colleagues have complained that they have to do about 75% of the work before someone in a lesser-developed country completes the modeling and simulation assignment. In that case, where is the efficiency? And, does this simply add to our work load? Yet, how should multinational corporations conduct effective collaborative R&D work around the globe if the research consumers are spread around the globe as well? Some companies have concluded that the benefit outweighs the cost for two reasons – cheaper white-collar labor (short-term solution) and unique technical talent (long-term issues). Further, employees must often travel to establish relationships and to provide technical guidance, though one could always argue that much of the sophisticated work could be done via electronic means alone.

Would a particular product, appliance, or vehicle emit the same noise and vibration level anywhere in the world? Are the test conditions and infrastructure the same (including the electrical, environmental, and ground effects)? Can or should we design universal products and engineered systems in terms of consistent noise and vibration performance? This would assume that the human response (especially perception) is now universally uniform and insensitive to cultural and geographical differences. Is this the unintended result of globalization? If this assumption is valid, then we should ask: Should we have a universal set of emission (and immision) standards and product labels and so on?

How do we teach the global issues in our undergraduate and graduate courses? Engineering and technology accreditation boards around the world, such as ABET (www.abet.org) in the United States, are now insisting on some coverage of global issues at the undergraduate level. But there are no such requirements at the graduate level, where many of the vibration and acoustics courses now reside. Do we need to alter our textbooks and course notes and bring the effects of a flatter world into them? I do recall one topic I covered that was very mathematical (elegant and yet instructive in terms of generic design principles). Then one student remarked that they should not be expected to learn such complicated theories since engineers in India and China were much better at solving such problems.

Where do we draw the line? Should we start to teach them how to outsource basic engineering principles and design concepts? Do we need to reconfigure our curricula and adapt them to the needs of a flat (or flattening) world? Should we integrate the demands of market forces and global competition into our courses and let the students know that some lower-skilled engineering work (such as manufacturing) will be exported to a nation with cheaper labor.

If you would like to know more about the educational issues, please refer to the following report from the National Academy of Engineering (www.nae.edu): *The Engineer of 2020: Visions of Engineering in the New Century* that is available on line at: www.nae.edu/nae/engeducom.nsf/weblinks/MCAA-5L3MNK?OpenDocument.

What is the best form of communication in the 21st century? Do we need any face-to-face interaction or could we simply work using web or video conferences? Is there any future for many international conferences and journals? Or should we simply post our papers (or opinions) on various web sites (open source) and let users decide how to interpret and use (or abuse) the information?

There is no answer key to accompany these questions, but I hope to revisit this issue in my next editorial based on the e-mail responses. Finally, I acknowledge the assistance of several colleagues (from the 'street' to the mainstream noise and vibration community) who provided comments and suggestions and will remain unnamed in a flat world! SV

Please comment on this editorial. Send them to: singh.3@osu.edu.