Think Globally, Act Locally

Once we accept our limits, we go beyond them. —Albert Einstein

The topic on everyone's mind these days is globalization, from the rapid changes taking place in India and China to the push for European union and the threat that outsourcing poses to jobs in developed countries. Election results in France and The Netherlands against ratification of the European Union constitution attest to the fact that not everyone thinks that globalization is a good idea.

Whether or not one thinks globalization is positive, it is nevertheless happening. The developments in China are similar to those in the United States in the late 19th century: rapid industrialization, enormous growth of capital and generation of wealth, a profound optimism, and a sense of "manifest destiny." The difference is that these changes are taking place in an age of instant global communications. Satellite communications and the Internet have removed time and space bariers to global business transactions. The world's economies are much more interconnected than in the past.

A generation ago, the world saw the rise of the German and Japanese economies following World War II. In this case, Germany and Japan were already industrialized nations and were rebuilding themselves, aided by the U.S. Marshall Plan, after the devastation of the war. The first stage in the rise of the Japanese economy was one of imitation and production of low-cost goods. I can remember, as a young child in the 1950s, when my friends and I got small, cheap Japanese AM transistor radios, the very first transistor radios on the scene. We would compare radios with respect to the number of transistors each contained. Stamped in large letters on the front of each radio were "7 transistors," "14 transistors," and so forth. Of course, we had no idea what a transistor was, but it seemed clear that more had to be better, and so the kid whose radio had the most transistors always had bragging rights. Later, Japan demonstrated the importance of quality, as the U.S. auto industry learned at considerable pain. In the field of robotics and automation, Japanese industry showed us that uniform manufacturing quality, and not necessarily labor cost savings, was the primary advantage of robotics and automated manufacturing.

Mark Spong in Nanjing, China, at the Qin Huai River. Mark presented a plenary lecture at the 2004 International Conference on Advances in Dynamics, Instrumentation, and Control (CDIC'04).

Globalization in India and China is following a somewhat different path, as major corporations such as IBM, Microsoft, and General Motors are investing huge sums in production facilities. Thus, the Chinese and Indian economies can leapfrog the early stages of industrialization and innovation experienced by Japan and become economic and technological leaders more rapidly.

What does globalization mean for the IEEE Control Systems Society (CSS)? Although the IEEE and the CSS have always been international organizations, there has been a distinct U.S.-centric viewpoint within the organizations. This viewpoint was natural when the membership was predominantly from the United States. Today, the CSS has just over 50% of its members from outside the United States, and the percentage of non-U.S. members is increasing. In other words, the growth potential for our Society is mostly outside the United States. This potential provides the CSS with an opportunity to develop a strong presence in places where we have not previously had much activity.

How can the CSS increase its global presence? I encourage CSS members in both developed and developing countries to "think globally and act locally" by forming local CSS chapters that can take advantage of globalization by inviting distinguished speakers from around the world, organizing workshops with international participants, and sending members to international conferences. I encourage our Society to involve young people from all countries in Society activities to prepare them for future leadership roles. The CSS can continue to form international partnerships for joint sponsorship of conferences. The joint IEEE Conference on Decision and Control and

European Control Conference (CDC-ECC) in Seville, Spain, this year is a very exciting venture that I hope will be repeated in other venues and with other Societies in the future. Our flagship conference, the CDC, has previously been held in Athens (1986), Brighton (1990), Kobe (1996), Sydney (2000), and The Bahamas (2004). We can look for an increase in the number of CDCs that take place outside the United States in the future.

It is interesting to speculate about the technical impact of globalization on the CSS and on the field of control. Scientific research does not take place in a vacuum. Cultural and language differences affect the direction of scientific investigation. Economic and political climates affect the direction of engineering research through government funding and national priorities. A recent search on IEEE *Xplore* using the keyword "globalization" resulted in 728 papers with topics such as managing projects in a 24-hour development cycle, incorporating language differences in software, globalization of education, e-commerce, global research funding opportunities, and global supply chains.

An immediate consequence of globalization in the Internet age is a trend toward uniformity, which tends to lessen cultural and language barriers. As an example, the German educational system is migrating toward a B.S./M.S./Ph.D. model of higher education, at least partly motivated by competition for the best international graduate students.

There are tremendous opportunities for control resulting from globalization in the post-9/11 world. Our field is about making decisions under uncertainty, with limited information, taking into account tradeoffs and constraints. Developments in other areas, such as in materials and sensors, open up new applications that require systems and control ideas. The primary tradeoff is between security and the free flow of information, people, goods, and services. A computer virus can circle the globe in minutes. A real virus, such as that causing avian flu, can circle the globe in a day. A host of biological hazards such as mad cow disease are no longer bound by geographic constraints. Similarly, container ships, cargo planes, and passenger planes cross international borders thousands of times each day. Principles of control can be used in conjunction with new sensor and actuator technology to maximize both border security and flow across borders. I believe that control will help to facilitate globalization and will, in turn, benefit from globalization.

Society News

I want to announce a new development that I think will have a very positive impact on CSS-sponsored conferences. As you know, the Conference on Control Applications (CCA) is a yearly event sponsored by the CSS. In the past, the CCA has often been held jointly with the International Symposium on Intelligent Control (ISIC) and the Conference on Computer-Aided Control System Design (CACSD). In fact, in 2006 the CCA/ISIC/CACSD will again be held jointly in Munich, Germany. The CSS Board of Governors has decided to make this arrangement permanent by creating a new event, called the Multiconference on Systems and Control (MSC). The first MSC will be in Singapore in 2007 with Sam Ge as the general chair. The MSC will host the CCA and ISIC each year and the CACSD every two years. More importantly, the MSC will be a mechanism for adding new conferences in emerging topics, both CSS conferences and conferences cosponsored by other IEEE Societies and groups outside of the IEEE. The MSC will grow into a major event for the Society.

IEEE TAB Meeting Highlights

I want to mention one highlight from the June IEEE Technical Activities Board (TAB) meeting, the formation of the IEEE Systems Council. Systems engineering is often viewed by people as too broad to qualify as a discipline. But I think the breadth of systems engineering is also its strength, as engineering systems become increasingly complex. More and more engineering jobs deal with systems integration rather than component design. I am told repeatedly by employers that they are looking for engineering graduates who are broadly educated, with exposure to an array of disciplines. Moreover, employers are looking to hire students with exposure to business, product development, international aspects, and experience working in teams. I can think of no better training for systems engineering than control systems. I want to encourage the CSS to take an active leadership role in the new IEEE Systems Council.

I will end with an old joke about systems versus traditional engineering: "What is the difference between a Ph.D. in systems engineering and a Ph.D. in one of the more traditional disciplines like electrical or mechanical engineering?" A traditional Ph.D. requires a student to become an expert on a single topic. This means that, as one delves deeper into a particular topic, some breadth must be sacrificed. So traditional Ph.D. students end up learning more and more about less and less, until they finally know absolutely everything about nothing. Systems engineering students, on the other hand, must study a variety of engineering disciplines. But to obtain such breadth, some depth is inevitably sacrificed. So systems engineering students end up learning less and less about more and more until they finally know absolutely nothing about everything.

The truth, as in all things, lies somewhere between the two extremes. I look forward to receiving your comments at mspong@uiuc.edu.

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