Intelligent Systems: An Assesment of the Past and the Prospects for the Future

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The last decade of the last millennium is characterized by what might be called the intelligent systems revolution, as a result of which, it is now possible to have man–made systems that exhibit ability to reason, learn from experience and make rational decisions without human intervention. Prof. Zadeh has coined the word MIQ (machine intelligence quotient) to describe a measure of intelligence of man-made systems. In this perspective, an intelligent system can be defined as a system that has a high MIQ.

This talk first discusses the characteristics of the information age, pointing out that the agricultural revolution had local scope and local impact whereas the information revolution has global scope and global impact. The erosion of the boundaries between different disciplines in the information age is considered and the growth of information available is pointed out to. It is argued that these changes has necessitated a paradigm shift from teaching to learning, accompanied by changes in the skills that need to be acquired. What an engineer of the 21st Century needs to know and what skills he need to have are elaborated upon and, considering the general trends in industry, the capabilities that he/she needs to develop in order to be able to cope with the changes are discussed. It is said that mechatronics offers a *best practice* for synthesis and meeting the challenges. The evolution of Mechatronics over the past 40 years is considered and a new definition of mechatronics for the 21st Century is cited.

The talk then dwells upon how to define "intelligence" of man-made machines and continues with a discussion on computational intelligence, its main components and compare it with biological and artificial intelligence. The paradigm shift from computation with measurements to computation with perceptions is also pointed out to. The state-of-art reached in intelligent systems is overviewed with examples and a perspective on the future is given, based on “futurology” rather than “prophecy”. The reasons behind the slow pace of developments are discussed, tying it to the availability of the computing power. The trends seen in this respect over the last century are overviewed and it is argued that the Moore’s Law will have to reach an end, not so much because of technological difficulties but because of financial ones. Quantum and molecular computing are offered as possible alternatives.

The presentation then considers the changes observed in the manufacturing industry. The goals of the Intelligent Manufacturing Systems Consortium are overviewed with special emphasis on Holonic Manufacturing Systems. Some demonstrations are screened. These changes in industry indicate a paradigm shift from industrial electronics to industrial informatics.

In the closing parts of the presentation, a technological roadmap is given, pointing out to the necessary breakthroughs. The necessity for understanding cognitive perception is emphasized. The talk closes with a consideration of the possible research directions in mechatronics and robotics as driving forces behind the development of intelligent systems.