Abstract for the ASME-JSME-KSME Joint Fluids Engineering Conference 2011
AJK2011-FED
July 24-29, 2011, Hamamatsu, Shizuoka, JAPAN

AJK2011-PO003

RESEARCH AND DEVELOPMENT STRATEGIES FOR FLUID MECHANICS FOR THE FUTURE

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ABSTRACT

Mechanical engineering is one of the oldest science and engineering disciplines in human history, perhaps along with civil engineering. However, mechanical engineering can distinguish itself from civil engineering in that it has played a pivotal role in the Industrial Revolution by allowing us to extract power from fossil fuels through thermal engines, which has liberated mankind from hard labor to survive.

However, since the late 20th century, other science and engineering disciplines, such as chemical engineering, electric engineering, electronic and computer engineering, brain science and bio-science, have rapidly emerged. These disciplines have evolved even more rapidly into new forms of disciplines. This presentation deals with how mechanical engineering, more specifically fluid mechanics, has to adjust to the new R&D environment to maintain the tradition of its R&D innovation.

Fluid mechanics is a generalized form of mechanics, dealing with the transfer of energy and matter. Therefore, it has wide scientific applications ranging from astronomy and power generation to nano-science. If more generalized, fluid mechanics can be applied to social sciences, such as economics; therefore, it has the potential to play a central role in the era of fusion science.

These days, the most important area we need to be truly concerned with is the field of energy and environment. Excessive CO2 emission is able to trigger climate change while mankind does not have the sufficient capabilities to adapt to the change. The U.S. is currently the number two CO2-emitting country in the world, second only to China. But their historic responsibility during the 20th century was overwhelmingly greater than any other country in the world. The U.S. now emits CO2 approximately 20 tons/year/person, which is about 4~5 times greater than the world average and about 8 times greater than the emission level to offset the atmospheric CO2 increase. On the other hand, Japan and Korea emit CO2 about 10 tons/year/person, which is a typical emission level for an industrialized country. Korea, having experienced a much shorter period of industrialization, has neutral historical responsibility. Nevertheless, future emission of CO2 will have a significant climate forcing effect on all countries.

The problems of energy and environment are caused mostly by industrialized countries, but the people in poor, non-industrialized countries will suffer first. However, the social and technological efforts to mitigate climate change are very poorly coordinated. The poor coordination is perhaps caused by too much fragmentation of scientific and technological disciplines. The current problems of energy and environment cannot be solved by just a few innovative or new technologies; it also requires proper integration with other technologies as well as the social system.

Since mechanical engineering has invented the industrial society, it is time that mechanical engineers must find the solution for a sustainable industrial society. Fluid mechanics, being a science of fusion, must play the key role in the global efforts to mitigate climate change.

Myself being a fluid mechanical engineer working in the field of environment, I will talk about what can be done in the R&D field of fluid mechanics.