Frontier & Platform Research for Social Innovation Business

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HITACHI'S Social Innovation Business is a leader in its field, combining a diverse portfolio of technologies in the natural, social, and system sciences. In 2009 when I edited a feature issue of Hitachi Review Vol. 58 No. 4 that focused on human-oriented research and development (R&D) in the social sciences, I defined human society in terms of different "spaces," specifically the virtual, physical, and human spaces and how they are tied together by transportation. Articles in that issue covered nine different areas of Hitachi's R&D, describing technologies that related directly or indirectly to the social sciences in these different spaces.

In this issue, we consider the advanced scientific technologies behind Hitachi's Social Innovation Business, grouping them into three categories. The first category is the use of electron microscopes to measure natural phenomena. Hitachi invented the technology behind spin-polarized scanning electron microscopes (spin SEMs), and one of the articles describes how they can be used to observe the spin direction (magnetic orientation) of domains on the surface of a magnetic material, with applications that include improving the efficiency of electric generators and electric motors (p. 264). A diffractive imaging technique is also presented for visualizing the three-dimensional structure of light-element materials such as carbon nanotubes, graphene, and magnesium oxide (p. 269).

The second category relates to the use of information technologies to model, simulate, and analyze natural phenomena. This includes state-of-the-art technologies for modeling and simulation of high functional materials (p. 239), fluid dynamics (p. 244), and welding (p. 249). These technologies are the result of synergies between R&D at different Hitachi businesses, from power plants and home appliances to supercomputer systems. Another article describes recent technological developments for managing the information technology (IT) resources used to analyze real-world Big Data (p. 279).

The third category deals with the control of natural phenomena in various manufacturing processes, for which Hitachi uses the Japanese term "monozukuri" (the art of manufacturing products). This includes a technique for modeling the propagation of problems in production at one or more factories (p. 274). Other articles on monozukuri deal with lithium-ion batteries and power inverters (p. 259 and p. 254).

Because social infrastructure is tied so closely to interactions between people, its human aspects increase exponentially with population growth. System sciences such as artificial intelligence provide effective tools for solving such non-polynomial-order problems. Hitachi is well placed to develop system science technologies through its work on constructing various advanced systems.

Through its R&D, Hitachi's Social Innovation Business seeks to play a leading role in building a sustainable human world by combining proprietary technologies in the natural, social, and system sciences.