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Recent progress on soft transducers

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Soft transducers have many features that are desirable for various devices. An especially attractive of soft transducer is dielectric elastomer. Dielectric Elastomer (DE) is a relatively new transducer technology uses rubberlike elastomers as actuator and sensor materials. DE actuator has fast speed of response, with a high strain rate. DE actuator having only 0.1 g of DE materials can lift the weight of 2 kg, using carbon system electrodes. DE can also be compliant 2D and 3D sensors. The use of DE actuator in the reverse mode, in which deformation of the elastomer by external mechanical work is used to generate electrical energy, has been gaining more attention (see Fig. 1). DE has shown considerable promise for harvesting energy from environmental sources such as ocean waves, wind, water streams including Karman vortices, solar heat, or human motion in our recent study. We also found that DE sensors with the generators could be useful for remote monitoring and patient treatment. Even in primary industries like agriculture, fishery and forestry, IoT using wireless networks is being introduced to increase productivity and value. These systems are often used outdoors, and the supply of electricity is a major issue in their design. Because DE can generate electricity from such a variety of energy sources, it can be used to power DE sensor systems. The combination of DE power-generating systems with various DE sensing systems will also make it possible to conduct sensing on a global scale, and may even make a significant contribution to the creation of systems that will protect human lives from various disease, natural disasters, or emergencies. DE has moved now from the research and development stage to the commercial domain with research and development on practical applications, and furthermore to the mass production stage.

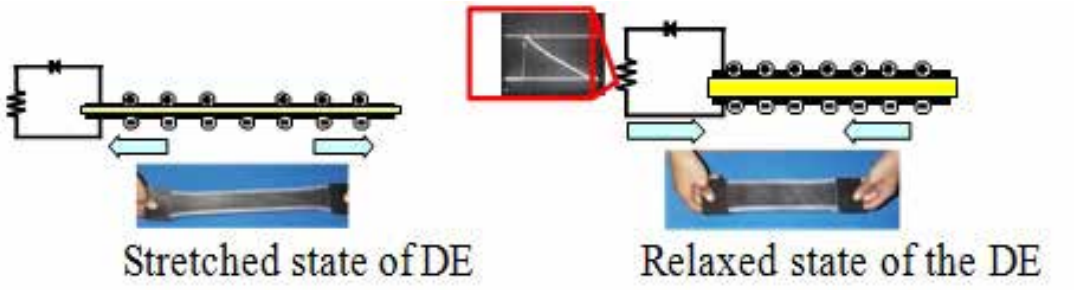

Figure 1: Operating principle of dielectric elastomer power generation (DEG); the DEG is basically a stretchable capacitor. If a charge is applied to the DEG in the stretched state then work done by the contracting elastomer is converted into electrical energy (as illustrated by the voltage across the resistor in the right illustration).

Biography

Seiki Chiba was Executive Director for Advanced R&D Project Development, Stanford Research Institute (SRI International). He served on SRI for 20 years. He was supervising advanced R&D programs including Japanese Government projects. Now, he is CEO of Chiba Science Institute. He is the author or coauthor of more than 300 publications in various areas including artificial muscle actuators & generators, hydrogen safety, and high temperature membranes for hydrogen production. He has a PhD in Metallurgy & Material Science from the University of Wales (Britain). He received IAAM Medal for outstanding contribution in the field of Advanced Material Science and Technology.

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