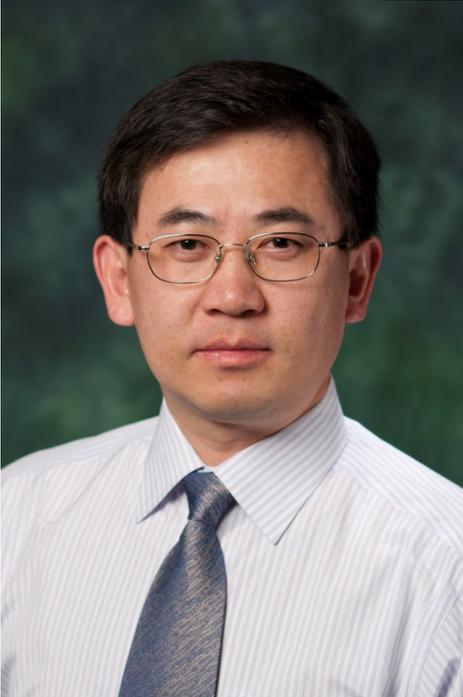


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Electrowetting Chip Cooling and Electrowetting Solar Tracking



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Abstract: We are developing a solar concentrator using a novel optofluidic system based on electrowetting. The electrowetting effect controls the contact angle of a liquid on a dielectric surface through the application of an electric field between them. With two immiscible fluids in a transparent cell, we can actively control the contact angle along the fluid-fluid-solid tri-junction line and hence the orientation of the fluid-fluid interface via electrowetting. The naturally-formed meniscus between the two liquids can function as an optical prism. Without any mechanical moving parts, this dynamic liquid prism allows the device to adaptively track both the daily and seasonal changes of the Sun's orbit, i.e., dual-axis tracking. This invention reduces capital costs for concentrating photovoltaics (CPV) and increases operational efficiency by eliminating the power consumption of mechanical tracking. Most importantly, the elimination of bulky tracking hardware and quiet operation will allow extensive residential deployment of concentrated solar power. In comparison with traditional silicon-based PV solar cells, the electrowetting-based self-tracking technology will generate ~70% higher green energy with a 50% cost reduction. The success of this program has huge market impacts and will enable a paradigm shift in the role of concentrating photovoltaics in the U.S. energy market. Besides, we will also introduce electrowetting-controlled digital heat transfer for electronic chip cooling.

Biography: Dr. Jiangtao Cheng currently works as Associate Professor in the Department of Mechanical and Energy Engineering, the University of North Texas. Dr. Cheng received his Ph.D. degree in Physics from Purdue University in 2002. He also has a M.S. degree in Computer Science from Purdue University and a B.S. degree in Applied Physics from Peking University, China. After his Ph.D., Dr. Cheng worked as a postdoctoral research associate at Texas A&M University (2002-2004), a postgraduate researcher at the University of California, Irvine (2004-2006), and a research associate in the Department of Mechanical and Nuclear Engineering, the Pennsylvania State University (2006-2007). Prior to joining the University of North Texas in 2011, Dr. Cheng was a research scientist at Teledyne Scientific Company (formerly Rockwell Science Center). He has served as the Principal Investigator and Co-Principal Investigator of several research projects with a total funding exceeding \$2 million. He was the recipient of the Science and Technology Advancement Award from *China Ministry of Nuclear Industry* in 1997 and the Outstanding Student Paper Award from *the American Geophysical Union Meeting* in 2003. In 2010, Dr. Cheng's project "Optofluidic Solar Concentrators" was announced by *the U.S. Department of Energy* as one of the "six transformational energy research and development projects that could revolutionize how the country uses, stores, and produces energy". He has extensive experience in energy technology, micro/nano-fluidics, multiphase fluid flow, nano-fabrications, thermal-fluid sciences and CFD numerical simulation.