Application of CNT in innovative Sensor and Machining Processes

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Abstract

Carbon nanotubes (CNTs) have found applications in many areas. In this presentation, We will discuss the design of a skin-like sensor using CNT by exploiting its piezoresistive property as a strain sensor, inspired by biomedical systems. The sensor is scalable and have potential of applications in civil and mechanical infrastructure as well as anthropomorphic contact interface. The modeling of anthropomorphic contact interface in typical biomedical applications will also be discussed. In additional, investigation on using vertically aligned CNT forest as a tool to perform innovative ductile machining processes, such as lapping and polishing, on brittle materials in ductile machining regime will be discussed. Such processes can make impacts on surface machining such as the manufacturing of silicon, III-V, II-Vi, and optoelectronic wafers made from materials which are brittle in nature. The current wafering processes utilize rollingindenting or rolling-scratching process which creates subsurface damages (SSD) and cracks that have to be removed in subsequent processes. The research on ductile machining of brittle materials is characterized by the orthogonal cutting modeling with shear as the primary mechanism of material removal which is free of subsurface damage. The challenges of research are in the estimation of the depth of cut and process optimization to ensure that the process parameters remain in the ductile machining regime.

Bibliography

Dr. Imin Kao is the Associate Dean of the College of Engineering and Applied Sciences, and a professor of the Department of Mechanical Engineering at Stony Brook University (SUNY). He is also the founding Faculty Director of the Information and Technology Studies Undergraduate College (ITS College)–one of the six thematic Undergraduate Colleges at Stony Brook University, established to transform the way in which undergraduate students experience University life. Being

the Director of the Systems Engineering and Integration Laboratory (SEIL) at Stony Brook, he conducts research in the areas of Microsystems and MEMS, intelligent fault detection and diagnosis, robotics, intelligent contact interface, stiffness control, wafer manufacturing, and wafer slicing using wiresaw.

He served as an Associate Editor of the IEEE Transaction of Robotics and Automation and the International Journal of Advanced Manufacturing Systems, as well as an Associate Editor of the IEEE Robotics and Automation Society Conference Editorial Board. He is a member of the IEEE and the ASME.

Craig Capria (Student)

Biography

Craig Capria is a PhD candidate from Stony Brook University in New York and a licensed Professional Engineer in the state of New York. He received the MS degree in mechanical engineering from Stony Brook University in 2000.

He is currently an assistant professor in the Engineering/Physics/Technology Department at Nassau Community College in Garden City, New York. His current research interests include robotic grasping and viscoelastic contact mechanics, and fault detection and diagnosis (FDD). Prior to his tenure at Nassau Community College, he worked as a design engineer at a private firm on Long Island, where he developed seismic restraint, vibration control, and sound attenuation devices for commercial structures and mechanical equipment.

He is a member of the American Society of Mechanical Engineers (ASME), the Society of Professional Engineers (SPE), and the American Society of Engineering Educators (ASEE).