Machining of Clots and Plaques Inside the Blood Vessels

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Abstract:
The blockage of a blood vessel due to clots or plaques is a major threat to human health. Thrombectomy and atherectomy are two treatment procedures for the removal of clots and hardened plaque, respectively, inside the blood vessel to restore blood flow. Micro-machining using catheter-based minimally invasive medical devices is an enabling technology for the safe and effective removal of hardened plaques or tough clots and has great opportunities for innovative medical devices and impacts on human health. Thrombectomy is the physical removal of blood clots in the brain for stroke treatment. Current aspiration catheter and stenting retriever only allow for about 50% complete recanalization for acute arterial clots. For effective removal of chronic venous clots in pulmonary embolism and deep vein thrombosis, a cutting-based thrombectomy device using a high-speed rotating tool at the tip of the catheter tube and the vacuum for suction of the chip for thrombectomy is presented. Atherectomy is the internal grinding of hardened calcified plaque in the heart's coronary artery or knee's popliteal artery using the diamond grinding wheel rotating up to 230,000 rpm. The experimental discovery of the orbital motion of the grinding wheel, the computational fluid dynamic modeling to analyze the orbital motion, smooth particle hydrodynamic modeling of material removal in grinding, innovation to integrate the miniature (less than 1 mm diameter) grinding wheel at the tip of the driveshaft, and a startup to explore the commercial opportunity are discussed. This talk concludes with the evolution of biomedical manufacturing and impacts on manufacturing in healthcare.

Biography:
Dr. Albert Shih is Professor in Mechanical Engineering, Biomedical Engineering, and Institute of Gerontology at the University of Michigan. He received PhD from Purdue University in 1991 and was a manufacturing engineer at Cummins and an Associate Professor at NC State University before joining the University of Michigan in 2003. He served in the Advanced Manufacturing National Program Office in 2017 and was the President of NAMRI SME in 2019-2020. Dr. Shih is a pioneer in biomedical manufacturing. He is the recipient of the Fulbright Scholar, SME Taylor Research Medal and Education Award, and ASME Milton Shaw Manufacturing Research Medal, Blackall Machine Tool & Gage Award, and William Ennor Manufacturing Technology Award as well as the Editor-in-Chief of ASME Journal of Manufacturing Science and Engineering. Professor Shih is the Fellow of ASME, SME, and CIRP.

***This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.**
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