UTA Bioengineering Department Seminar

Fantastic Voyage: Tiny Robots in Bodily Fluidic Environments

MinJun Kim Ph.D.
Robert C. Womack Endowed Chair
Professor of Engineering

Southern Methodist University
Department of Mechanical Engineering

Wednesday, September 06, 2017, 12:00-1:00 p.m.
NH 203 (UTA)

Abstract:

How can corkscrew nanorobots drill through blocked arteries? Surgeons will soon be deploying armies of tiny robots to perform microsurgeries throughout the body. The realization of reconfigurable modular nano/microrobots could aid drug delivery and microsurgery by allowing a single system to navigate diverse environments and perform multiple tasks. So far, nano/microrobotic systems are limited by insufficient versatility; for instance, helical shapes commonly used for magnetic swimmers cannot effectively assemble and disassemble into different size and shapes. Here by using nano/microswimmers with simple geometries constructed of spherical particles, we show how magnetohydrodynamics can be used to assemble and disassemble modular nano/microrobots with different physical characteristics. We develop a mechanistic physical model that can be used to improve assembly strategies. Furthermore, we experimentally demonstrate the feasibility of dynamically changing the physical properties of nano/microswimmers through assembly and disassembly in a controlled fluidic environment. Finally, we show that different configurations have different swimming properties by examining swimming speed dependence on configuration size.

Biography:

Dr. MinJun Kim is presently the Robert C. Womack Endowed Chair Professor of Engineering at the Department of Mechanical Engineering, Southern Methodist University. He received his B.S. and M.S. degrees in Mechanical Engineering from Yonsei University in Korea and Texas A&M University, respectively. Dr. Kim completed his Ph.D. degree in Engineering at Brown University, where he held the prestigious Simon Ostrach Fellowship. Following his graduate studies, Dr. Kim was a postdoctoral research fellow at the Rowland Institute in Harvard University. He joined Drexel University in 2006 as Assistant Professor and was later promoted to Professor of Mechanical Engineering and Mechanics. Dr. Kim has been exploring biological transport phenomena including cellular/molecular mechanics and engineering in novel nano/microscale architectures to produce new types of nanobiotechology, such as nanopore technology and nano/micro robotics. His notable awards include the National Science Foundation CAREER Award (2008), Drexel Career Development Award (2008), Human Frontier Science Program Young Investigator Award (2009), Army Research Office Young Investigator Award (2010), Alexander von Humboldt Fellowship (2011), KOFST Brain Pool Fellowship (2013 & 2015), Bionic Engineering Outstanding Contribution Award (2013), Louis & Bessie Stein Fellowship (2008 & 2014), ISBE Fellow (2014), ASME Fellow (2014), Top10 Netexplo Award (2016), KSEA & KOFST Engineer of the Year Award (2016), and IEEE Senior Member (2017).