Abstract:
The area of artificial muscle is a highly interdisciplinary field of research that has evolved rapidly in the last 30 years. Recent advances in nanomaterial fabrication and characterization, specifically carbon nanotubes and nanowires, have had major contributions in the development of artificial muscles. However, what can artificial muscles really do for humans? This question is considered here by first examining nature’s solutions to this design problem and then discussing the structure, actuation mechanism, applications, and limitations of recently developed artificial muscles, including highly oriented semicrystalline polymer fibers; nanocomposite actuators; twisted nanofiber yarns; thermally activated shape-memory alloys; ionic-polymer/metal composites; dielectric-elastomer actuators; conducting polymers; stimuli-responsive gels; piezoelectric, electrostrictive, magnetostrictive, and photostrictive actuators; photoexcited actuators; electrostatic actuators; and pneumatic actuators.

Biosketch:
Seyed M. Mirvakili received his BASc degree in electrical engineering with minor in nanotechnology and microsystems from UBC in 2011. For his MASc degree, he joined Molecular Mechatronics Lab in the electrical engineering department at UBC where he finished his degree in 2013. He started his Ph.D. in BioInstrumentation lab in the mechanical engineering department at MIT in September 2014 and finished his degree in May 2017. He joined Langer Lab at MIT in 2017 for his postdoctoral training. He has initiated and worked on various projects on topics including analog circuit design, bio-photovoltaics, energy storage devices, and artificial muscles for the past decade.