



Engineering  
Colloquium

## Mechanical Engineering Lecture in Design **Engineering Global Development: Using Emerging Markets Constraints to Drive the Innovation of Global Technologies**



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**Friday September 9<sup>th</sup> 4:00PM, 3-270**

This presentation will demonstrate how the Global Engineering and Research (GEAR) Lab at MIT characterizes the unique technical and socioeconomic constraints of emerging markets, then uses these insights with engineering science and product design to create high-performance, low-cost, globally-relevant technologies.

The talk will focus on GEAR Lab's research to connect the mechanical design of prosthetic limbs to their biomechanical performance, to create passive, purely mechanical prostheses that can enhance the mobility of amputees in developing and developed countries.

We have created a novel method of characterizing prosthetic feet that allows the stiffness and geometry of the foot to be optimized to induce able-bodied kinematics of the leg when it is loaded during a step. In prosthetic knees, we have determined how joint torque must vary as a function of leg mass, and how the correct torque profiles can be replicated with simple, passive mechanical elements.

Two emerging research themes in GEAR Lab will also be highlighted: drip irrigation and desalination. By characterizing the coupled fluid/solid mechanics within drip emitters, we have designed new drippers that operate at 1/10 the pressure of existing products, which can cut the overall pressure, pumping power, energy usage, and capital cost of drip irrigation systems by 50%. GEAR Lab elucidated a disruptive market opportunity in arid countries for photovoltaic-powered electro dialysis (PV-ED) desalination, which requires half the energy and reduces water wastage from 60% to <10% compared to reverse osmosis. Three village-scale PV-ED systems of our design will be piloted in India and Gaza this year.

These projects demonstrate how rigorous engineering theory combined with insights on emerging market constraints can yield high-value solutions relevant to poor and rich countries alike.