Mechanical & Aerospace Engineering

PROFILE

Chair: Michael W. Plesniak
202-994-9803
www.mae.seas.gwu.edu
Full-time faculty: 14
Undergraduate students: 116
Graduate students: 71
Annual research expenditures: $1.4 million

FACULTY

Pinhas Ben-Tzvi, **ASSISTANT PROFESSOR**
David F. Chichka, **ASSISTANT PROFESSOR**
Andrew D. Cutler, **PROFESSOR**
David S. Dolling, **PROFESSOR AND AIAA FELLOW**
Charles A. Garris, **PROFESSOR AND ASME FELLOW**
Stephen M. Hsu, **PROFESSOR AND ASME FELLOW**
Roger E. Kaufman, **PROFESSOR**
Michael Keidar, **ASSISTANT PROFESSOR**
James D. Lee, **PROFESSOR AND ASME FELLOW**
Youngsheng Leng, **ASSISTANT PROFESSOR**
Rajat Mittal, **PROFESSOR**
Michael W. Plesniak, **PROFESSOR, ASME FELLOW AND APS FELLOW**
Yin-Lin Shen, **PROFESSOR**
R. Ryan Vallance, **ASSOCIATE PROFESSOR**

RESEARCH AREAS

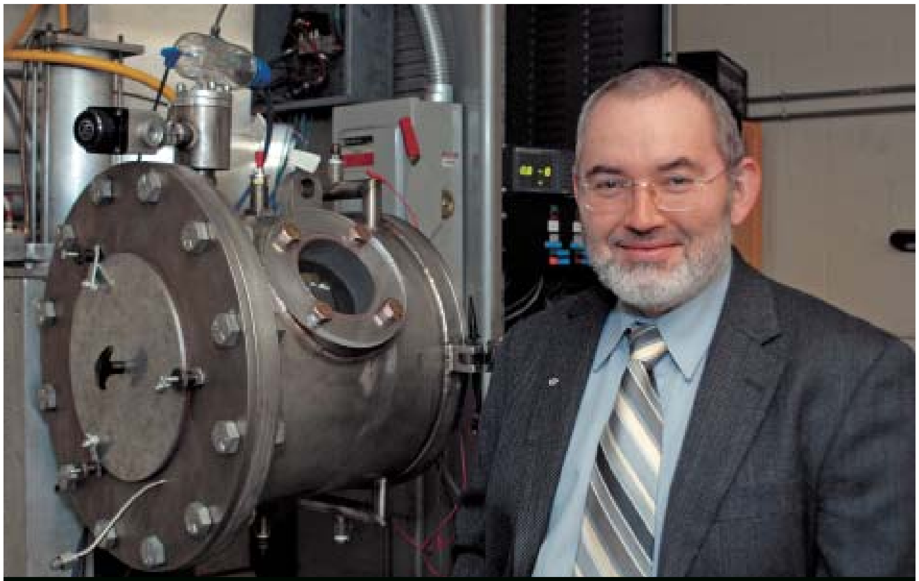
AEROSPACE ENGINEERING
Chichka, Cutler, Dolling, Garris, Plesniak

BIOMEDICAL ENGINEERING
Chichka, Kaufman, Lee, Mittal, Plesniak

DESIGN AND MANUFACTURING OF MECHANICAL AND AEROSPACE SYSTEMS
Ben-Tzvi, Garris, Kaufman, Leng, Shen, Vallance

FLUID MECHANICS, THERMAL SCIENCE, AND ENERGY
Cutler, Dolling, Garris, Hsu, Mittal, Plesniak

SOLID MECHANICS AND MATERIALS SCIENCE
Hsu, Lee, Leng



BOTH PERSPECTIVES: "We use a unique combination of both experimental and simulation approaches, which most labs in our field don't do," says Professor Michael Keidar.

Breakthroughs

Professor Michael Keidar of the Department of Mechanical and Aerospace Engineering directs GW's Micropropulsion and Nanotechnology Laboratory (MpNL), where he and his team study plasmas and their applications to healthcare, energy, defense, communications, and other sectors. For the uninitiated, Keidar explains, "Any material that can be heated to very high temperatures will transform itself into a plasma state where neutral particles will be transformed into charged particles, and that gives us a great deal of flexibility to manipulate this matter by means of electric and magnetic fields."

And what do they manipulate this matter to do? The MpNL currently has three main projects that work toward very different applications. One project uses plasmas to create new micro-propulsion devices called micro-vacuum arc thrusters, which provide small forces that can be used to correct or sustain satellites in their orbits. According to Keidar, the primary benefit of this kind of device is that it can operate for very long periods of time without any degradation of performance—the main problem with micro-propulsion these days—and this means that, unlike other similar devices, it could be used to go into a deep space mission.

A second project uses plasmas to grow new carbon nanotubes, which when used with hydrogen in a gaseous phase, could have great applications in hydrogen storage, and this could help create clean energy sources for our automotive industry. Keidar explains, "They can also be used as a bridge or connector between two electrodes that will be able to create a nano-device, and for this you need to be able to control the length of the nanotube. We're trying to establish what the limit is of the length of nanotubes, and we've already had some success in growing relatively long tubes and increasing their growth by a factor of 10. In this project, I'm collaborating with Professor Mona Zaghloul from the Department of Electrical and Computer Engineering."

The third project has provided the biggest breakthrough thus far. Working in collaboration with Dr. Mary Ann Stepp, a cell biologist with GW's Department of Anatomy, Keidar and his team have had a great deal of success using plasmas for biomedical applications. With support from GW's Institute for Biomedical Engineering, they generated a device called a cold atmospheric plasma jet, which they used to look at the interaction between it and skin-type tissue cells. They found that they can kill an individual cell without damaging the neighboring cells, which is helpful in treating skin cancer; they can manipulate a large number of cells and change their properties without damaging them; and they can change cell migration velocity, which could help in slowing down wound healing (to lessen the formation of scar tissue in younger patients) or possibly speed it up in older patients.