IIHCC

Solving problems that exist at, and along, the interdependencies between humans, community, and infrastructure to ultimately improve quality of life.

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What's Inside

Calendar

05/03/21 | ICAT Creativity and Innovation Day

05/07/21 | ICAT Call for Projects for Third ACCelerate Festival

06/18/21 | Call for Proposals for SEED Grants Focused on Global Change

If you have any questions, comments, or concerns, please contact us:

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For more information about IIHCC, visit our website

IIHCC FACULTY SPOTLIGHT

Myra **Blanco**

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Automated Vehicles

Public Policy

Heavy Vehicles

Human Factors

Naturalistic Driving

Can you summarize your work briefly?

What I do for VTTI is to ensure that I can provide opportunities to researchers and students to implement our mission, which is to "save lives, save time, save money, and protect the environment." Basically, I am an enabler who gets to meet wonderful people and put energy into developing partnerships between researchers, industry, government, and other stakeholders depending on the area of interest.

How do you see your work contributing to the goals and vision of IIHCC?

One of the important things that I like to stress is that IIHCC is Intelligent Infrastructure for Human Centered Communities. That "for" is very important and is the key to what we are doing. The DA is not intelligent infrastructure or sensors or new technology for technology's sake. It serves to assist humans in terms of quality of life, efficiency, and everything revolving around how we make processes and quality of life better for humankind. It is so important that we develop a transportation system that is equitable, and that we develop new technologies and new transportation methods that everybody can take advantage of and use. Those of us with the privilege of driving need to remember that it is not only about us, that it is about all people who want to have the ability to move around.

What other areas outside of your discipline would you consider for future research and proposal work?

One of the things that I am more excited about is the aspect of equity. I think that is so important. We are often more focused on the technology and the excitement that comes with something new. What we need to do is start using the intelligent part of the infrastructure and the technology to ensure that things are designed, developed, and implemented not for only early adopters or those who might be able to afford it but, in the long term, that we are approaching all levels and groups within the community. Another key initiative VTTI is leading is called Intern Hub, which is a program with students in mind. There is a lot of amazing research that happens at VTTI, with tremendous amounts of people looking at various types of new inventions, new developments, and other ways to help industry. Now, we are focusing resources into ensuring that the most exciting internship possibilities can happen in Blacksburg so that students do not have to leave their classes behind to be exposed to great industry programs.

Azim **Eskandarian**

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Can you summarize your work briefly?

I work in dynamics, controls, signal processing, and machine learning to enhance autonomous and connected driving. I have focused a lot on autonomous driving safety and reliability in the mixed manual and autonomous driving modes and connectivity among vehicles. This is built on my past research on automotive safety, called active safety systems or advanced driver assistance systems. They included research on lane departure warning and control, assisted braking, and adaptive (or automated) cruise control, among others, which have emerged in the market now.

How do you see your work contributing to the goals and vision of IIHCC?

IIHCC initially defined several areas of investigation, and one of them was autonomous driving and mobility. The idea that autonomy will help in the future of transportation and the future of mobility was one of the motivating principles behind creating IIHCC's various initiatives. Therefore, my work is directly related to that. IIHCC had several originally defined components, including intelligent materials, energy, mobility, etc., integrated with the human aspects, one of which was autonomy. In that regard, the question was, "how do we use autonomy to enhance human mobility or transportation and ensure safer transportation for all users?" and my work pursues that.

What other areas outside of your discipline would you consider for future research and proposal work?

If you delve into it, my work is very multi-disciplinary because it involves characterizing and understanding human role in the driving of vehicles. The driver assistance systems must understand human skills, perception, brain neuro-processing, and behavior to be properly designed and effective. Accordingly, I work in neuro-engineering to study brain waves' processing to get a better understanding of human actions and reactions or human perception of the environment. Distractions and task control are investigated, too.

We also try to understand human task control and its role and impact on safe driving. I also work with my students on machine learning because a lot of intelligent systems that are used for autonomous driving use AI and machine learning. These are tools for processing video or integrating sensory information or data for autonomous driving.

Dynamic Systems and Controls

Intelligent Systems

Machine Learning

Multi-body and Impact Dynamics

Autonomous and Intelligent Vehicles

PINAR ACAR AWARDED AIR FORCE OFFICE OF SCIENTIFIC RESEARCH INVESTIGATOR RESEARCH PROGRAM AWARD

Uncertainty is an issue that we all face in various ways each day. Our inability to predict changes or other sudden actors on the things we do, and study can be a serious inhibitor for success. In some cases, this uncertainty can be a mild inconvenience, but for others it can be tremendously serious, or even dangerous. For Air Force fighter jet pilots, any bit of uncertainty can be absolutely detrimental. Dr. Pinar Acar, and her team of researchers, are working to minimize, and even erase, the adverse effects that uncertainty can have on the tools and materials that people use every day.

Acar, an Assistant Professor of Mechanical Engineering, has been awarded the Air Force Office of Scientific Research Investigator Research Program award. The 3-year grant for $450,000 is, according to Acar, going to be used to attempt to "develop a numerical framework that will help us simulate materials intended to replace rare earth metals under different stressors (temperature, pressure, etc.)" Acar and her team are proposing theoretical work designed to further understanding of the magnetic behavior of microstructures. Microstructures are the fine structures within a material which can only be made visible by the use of a microscope, and Acar feels that these microstructures hold the key to improving the stability of materials in environments of high uncertainty.

To get specific, in these uncertain environments, many magnetic devices and materials (primarily found in sensors, actuators, etc.) stop working, putting those who rely on those devices in harm's way. The present solution to this has been to use rare earth metals in the creation of those devices, as they are historically very stable. However, as Acar points out, they are also a scarce material, particularly within American territory. This has become quite the hot topic within American

"A deeper understanding of the materials that make up our world"

defense communities, and as such the Air Force Office of Scientific Research has turned to Acar to find other materials that could replace rare earth metals without losing out on their stability.

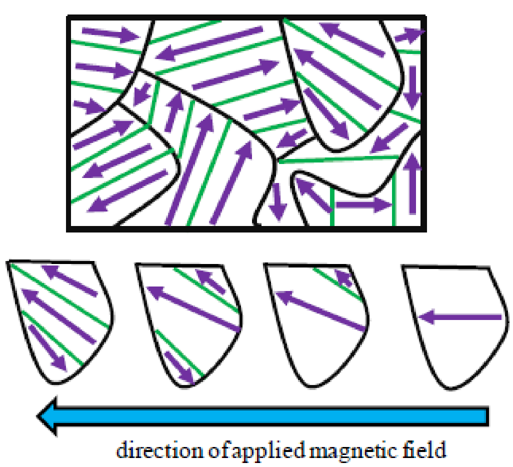
In response to this call, Acar and her team are attempting to develop a theoretical solution to understand what causes these magnetic instabilities (called a "phase transition," when material transitions from the ferromagnetic phase to the paramagnetic phase). Ferromagnetic means that the material is magnetically active, the component is working; however, in the paramagnetic phase, it stops working. The bulk of the work required of this project is mainly involving a material model that will be developed to study this phase transition problem. In addition to that, because the team is also looking at how the uncertainty and different temperatures and other physical parameters are affecting the problem itself, they are also developing some computational science solutions for uncertainty quantification.

As such, Acar and her team are engaging within multiple disciplines to pursue these solutions, including materials science, computational modeling, and mathematical uncertainty quantification. They will then try to integrate their mathematical uncertainty quantification model into the computational material models to understand what happens to the phase transition problem in the face of uncertainty in temperature or other environmental factors.

Buzzwords aside, Acar and her team are knocking on the door of some truly groundbreaking work with this project, as they are pursuing a solution to a specific problem but by doing so, they will be working to improve the overall efficiency of material consumption throughout the globe. Acar says that she "would like to understand what role each of these components plays in this broader challenge to understand the phase transition problem and improve the magnetic performance of materials." In other words, she is not just working to improve the sensors in fighter jets or to reduce the use of rare earth metals by American producers, though her solutions will certainly aid in those regards. Acar, here, is pursuing a deeper understanding of the materials that make up our world as well as the ceaseless changes and hazards that world throws at us every day.

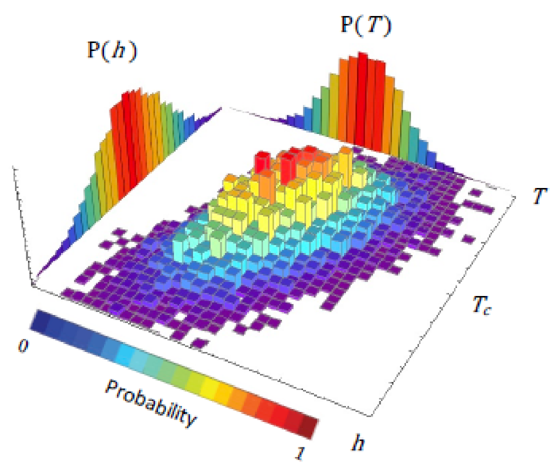
For VT News' highlight on Dr. Acar and this award, see this link (https://vtnews.vt.edu/articles/2021/01/me-faculty-aofsr2021-acar.html). For more information on the technical pursuit of this project, or questions for Dr. Acar in general, reach out to her via email at pacar@vt.edu.

UNDOPhase: UNcertainty-DOminated Phase Transitions in Magnetic Materials



A strong external field aligns the magnetization of domains and grains with itself.

Probability Density Description of Phase Transition



$P(h)$: Probability for external magnetic field

$P(T)$: Probability for temperature

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ASTRO LAB VIRGINIA TECH.

CALL FOR SCHOLARLY PUBLICATIONS FOR THE ISCE COVID-19 REPOSITORY

The Institute for Society, Culture and Environment (ISCE) maintains a repository of social science and policy-oriented COVID-19 publications that are authored by Virginia Tech faculty. If you have recently published any scholarly articles, research or policy briefs, blog posts or editorials that have social science or policy elements related to the pandemic, please send them to Yancey Crawford to include in ISCE's repository. The repository can be viewed on the ISCE website.