BYU PRISM

MODEL OPTIMIZE CONTROL

The BYU PRISM Group's Newsletter

What is Industry 4.0?

And what does it mean for you?

We do not know, with certainty, what the future will hold. We do know, however, that technology is everywhere, and that the future - whatever that might entail - will be built on digital transformation and businesses' ability to turn uncertainty into opportunity. According to IBM Marketing Cloud, 90% of the world's data today was created in the last two years alone, and the growth rate is projected to accelerate even more with emerging technologies. While the First Industrial Revolution may have been driven by steam power, we now see a world fueled by industrial applications of information and communication technologies.

With the idea of "Mastering the Fourth Industrial Revolution" standing at the center of the 2016 World Economic Forum Annual Meeting, global agendas were focused on the present-day's nature of innovation and the promises of technological advancement. Coined by Klaus Schwab, Executive Chairman of the World Economic Forum, the term Fourth Industrial Revolution - also called Industry 4.0 - refers to the exponential growth of new technologies that will revolutionize the manner in which we communicate, learn, understand the world, and progress as a society. As Industry 4.0 allows businesses to leverage instant data, optimize processes, and drive long-term productivity and growth, the benefits of adopting an Industry 4.0 model are exigent. It is evident that business leaders and executives must truly understand their operation and embrace today's spirit of innovation in order to adequately address the needs of society and compete on a global scale as other businesses invest in the future of Industry 4.0 technologies.

BYU PRISM
AT A GLANCE

Process Research and Intelligent Systems Modeling (PRISM) is a collaborative research group for the application of innovative advanced process control, optimization, cybersecurity, estimation, digital twin modeling, machine learning, and data science.

OUR TEAM

- Dr. Hedengren
- Adam Martin
- Charles Granger
- Cristina Stewart
- Daniel Hill
- Dawson McCrea
- Elizabeth Hart
- Joshua White
- Junho Park
- Nathanael Nelson
- Peter Cook
- Sam Arce
- Tanner Polley

For more information on Industry 4.0 and its applications, visit:
HTTPS://WWW.ISA.ORG/INTECH-HOME/2016/MAY-JUNE/FEATURES/INDUSTRY-4-0-INTELLIGENT-AND-FLEXIBLE-PRODUCTION

Do you want to collaborate with us? Reach out here:

CLICK HERE!

GEKKO to Facilitate Model Construction, Analysis Tools, and Visualization of Simulation and Optimization

Who knew a small, nocturnal reptile could make such a big difference?

Released July 28, 2020, the GEKKO Python package stands as just one example of how we, as the BYU PRISM Group, have contributed to the advancement of Industry 4.0 technologies. Developed by John D. Hedengren, Associate Professor in the BYU Chemical Engineering Department and head of the PRISM Group, and Logan Beal, a Ph.D. graduate from BYU in the Chemical Engineering Department, GEKKO solves mixed-integer, nonlinear, and differential-algebraic equations problems as an optimization suite for Python. As an object-oriented Python library, this package facilitates real-time optimization and may be utilized for chemical production planning, polymer grade transitions, integrated scheduling and control for manufacturing, energy storage systems, dynamic process model parameter estimation, and more. While flexibility is the ultimate focus of other modeling and optimization platforms, GEKKO is suited for flexibility while being best suited for large-scale systems and optimization applications. As the developers of the software you need to optimize problems and push ahead, the BYU PRISM Group knows how you can best harness the power of Industry 4.0 technologies to ensure maximum success for your company.

For a full report on the capabilities of the GEKKO Optimization Suite: **CLICK HERE**

MEET DR. HEDENGREN

Dr. John Hedengren is an Associate Professor at Brigham Young University in the Chemical Engineering Department. He leads the BYU Process Research and Intelligent Systems Modeling (PRISM) group with a current focus on structured machine learning for optimization of energy systems, unmanned aircraft, and drilling. Prior to BYU he worked in industry for 7 years on nonlinear estimation and predictive control for polymers. His work includes the APMonitor Optimization Suite with a recent extension to the Python GEKKO language. He led the development of the Arduino-based Temperature Control Lab that is currently used by 70 universities for process control education. His 60 publications span topics of oil production, drilling automation, smart grid optimization, unmanned aerial systems, and nonlinear predictive control.

Message to sponsors:

"We look forward to the collaboration between you and our energetic and intelligent group of researchers. Industry 4.0 is transforming many industries with much of the progress through shared innovations. This research center seeks to bring people and ideas together to increase the innovation and pace of progress. It does this through 3 routes including training, collaborating, and investing in professionals to tackle the next generation of challenges. We are glad that you are here and look forward to working together."

Are You in Trouble?

Autonomous robots might be coming to your rescue.

For nearly 20 years, the Defense Advanced Research Projects Agency (DARPA) has been holding what is called the DARPA Grand Challenge: a race of autonomous robots meant to accelerate the development of vehicles that might serve as supply convoys and participate in other hazardous military operations. When presented with unknown terrain and obstacles, the robots are to complete the course within a designated time limit for the chance to win a substantial cash prize.

September 24, 2021, marked the end of three years of DARPA's Subterranean (SubT) Challenge. This competition was focused on the development of autonomous robots that might assist in military and first-responder missions in subterranean environments where GPS and direct communication are unattainable. Moving across three events - the Tunnel, Urban, and Cave Circuits - the autonomous robots are to collect as many objects as possible while navigating an elaborate course exhibiting carbon dioxide emitting sources and various objects that might serve as an indication of a nearby human presence for robot competitors. When the robot gets in trouble, it is expected to be able to get itself out.

Despite the participation of eight teams of autonomous robots - including NASA's Jet Propulsion Laboratory (JPL)-led Team CoSTAR - Team CERBERUS, led by Dr. Kostas Alexis, emerged victorious in the SubT Challenge. With a team showcasing a legged and flying robot combination, Team CERBERUS successfully identified and reported 23 of the 40 artifacts placed along the DARPA course. Despite the $2 million cash prize awarded to the winning team, the true prize is found in the promising future for Industry 4.0's autonomous robots, as the competition pushed the limits of robotics technology and how it might be used for underground operations in the near future.

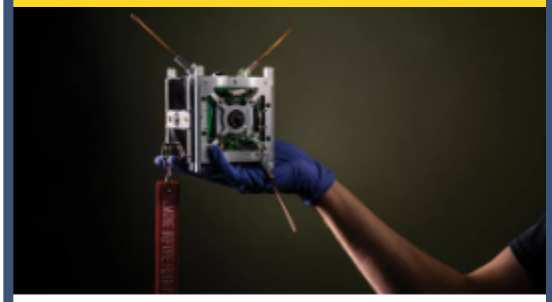
MORE FOR YOU

Articles that are out of this world...

Op-ed | Sound space industry regulation matters for the 4th Industrial Revolution

What role is there for space and satellite industries in Industry 4.0? Plenty.

CLICK TO READ!



Space Selfies

The BYU CubeSat, the NASA-sponsored selfie space cam, cheaply and safely monitors the condition of spacecraft.

CLICK TO READ!

Articles that hit closer to home...

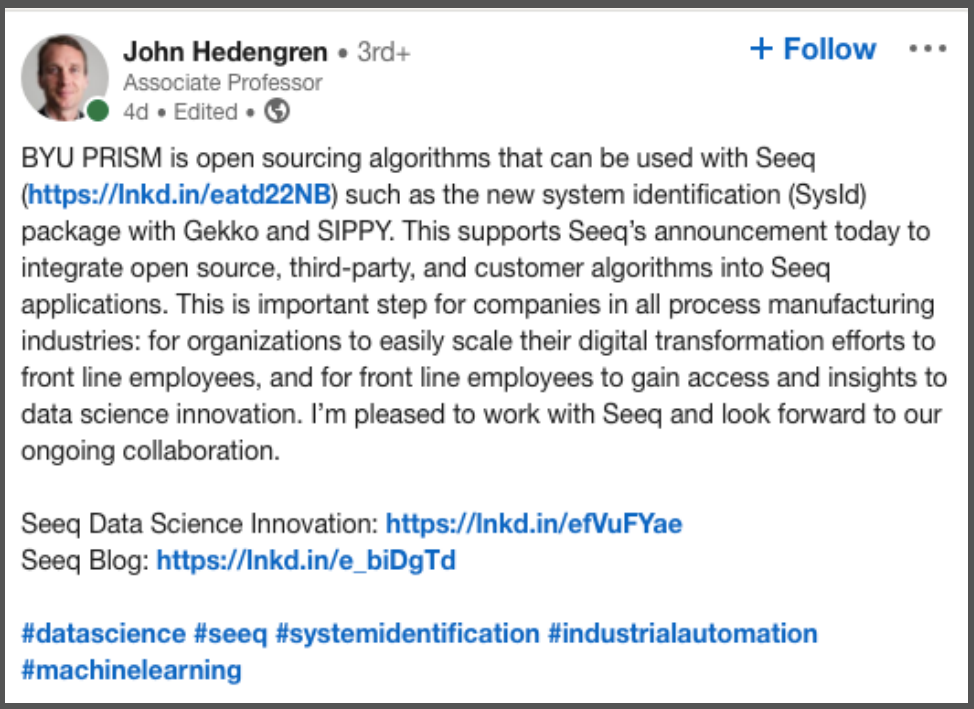
What Does It Take for a Woman to Truly Be Heard?

Groundbreaking BYU research shows how woman are subtly—and profoundly—shut down.

CLICK TO READ!

IN CASE YOU MISSED IT,

here is Dr. Hedengren's LinkedIn post about our current work with Seeq Corporation:



John Hedengren • 3rd+
Associate Professor
4d • Edited •

+ Follow

BYU PRISM is open sourcing algorithms that can be used with Seeq (https://lnkd.in/eatd22NB) such as the new system identification (SysId) package with Gekko and SIPPY. This supports Seeq's announcement today to integrate open source, third-party, and customer algorithms into Seeq applications. This is important step for companies in all process manufacturing industries: for organizations to easily scale their digital transformation efforts to front line employees, and for front line employees to gain access and insights to data science innovation. I'm pleased to work with Seeq and look forward to our ongoing collaboration.

Seeq Data Science Innovation: https://lnkd.in/efVuFYae
Seeq Blog: https://lnkd.in/e_biDgTd

#datascience #seeq #systemidentification #industrialautomation #machinelearning

For the full post:
https://www.linkedin.com/posts/hedengren_datascience-seeq-systemidentification-activity-6854580191981830144-PM4E/

More about Seeq's Integration of Machine Learning Algorithms:
https://www.automation.com/en-us/articles/october-2021/seeq-machine-learning-democratize-data-science

THOUGHTS FROM JUHNO PARK

"The PRISM group started a research and development project with Seeq corporation this summer. We started with the classical system identification methods such as linear time-invariant (LTI) models. However, it will expand to state-of-the-art hybrid machine learning and physics-based models as the project moves forward.Seeq users can install this software in the existing Seeq platform as advanced functionality.

We are excited to provide more industry partners with our long-term in-process system engineering and dynamic optimization with Seeq corporation." For more about Seeq, **CLICK HERE**.

Don't miss our webinar on December 8th at 12 PM EDT on System Identification with Industrial Data! **Join the Zoom link:**

CLICK HERE!