MATLAB EXPO

Preparing Students for Impactful Careers in Industry

Dr. Moiz Khan, MathWorks

MathWorks

[moiz-khan-phd]

Considerations for an Engineering Educator

Student

I want to build exciting systems and land a job!

All

Are we continuously adapting to engineering megatrends?

Dean

Is our Digital Learning environment and Software Infrastructure in order?

Learning Center

Are we utilizing our hybrid curriculum model?

Research Groups

We need more bandwidth to generate quality proposals.

Corporate Relations

Are we collaborating with industry?

Industry

Are your students ready to work on complex systems?

Leadership

Academic excellence and positioning

Faculty

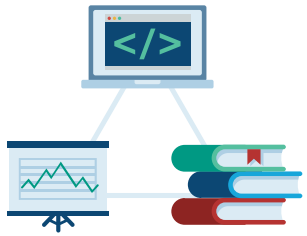
Securing funding for research and teaching activities.

Students

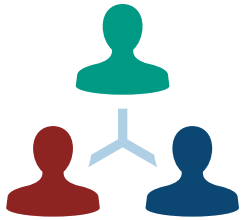
Learning transferable skills for the job market.

Industry

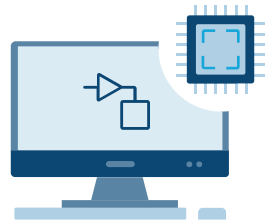
Employing students with technical and professional skills.



CURRICULA

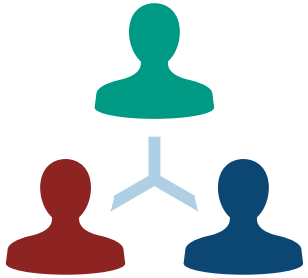


COLLABORATION

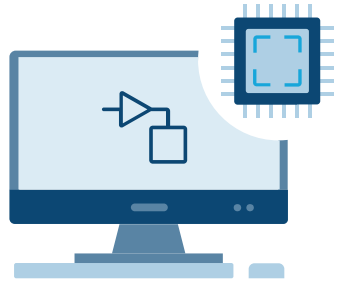


DIGITALIZATION

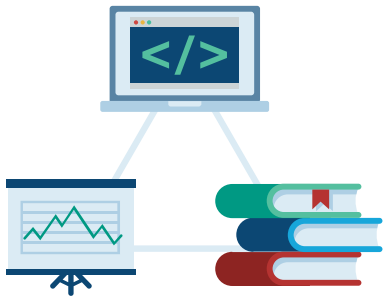
CURRICULA



COLLABORATION



DIGITALIZATION

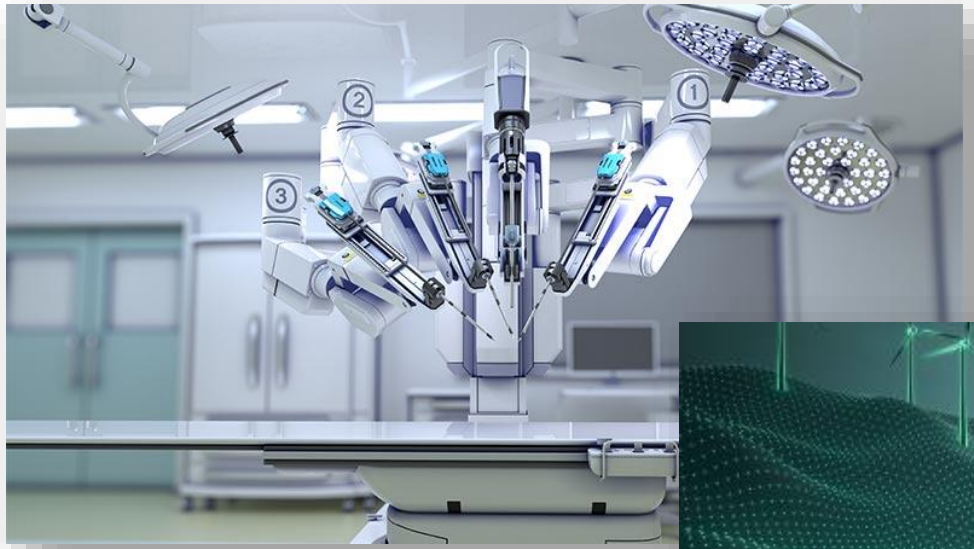


CURRICULA

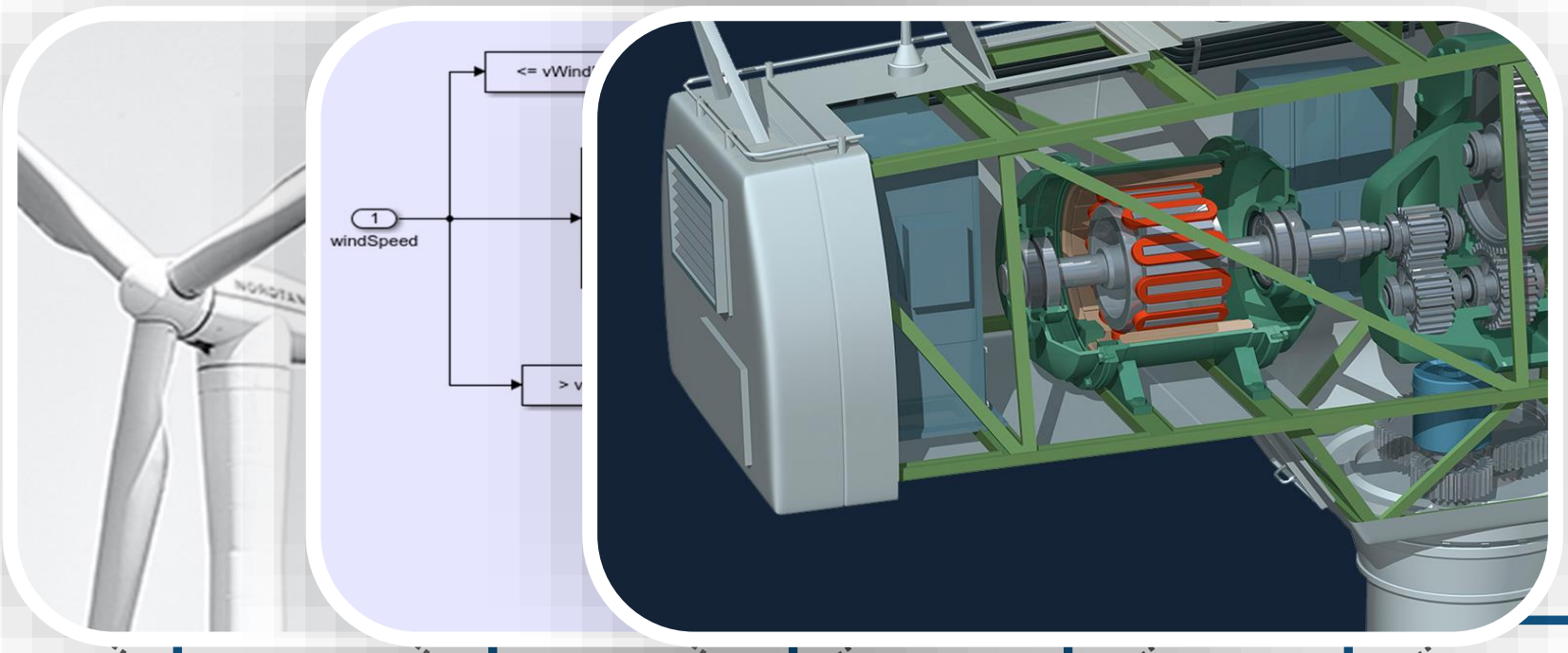
COLLABORATION

DIGITALIZATION

Engineering Systems are Multidomain = Curricula Should Be As Well

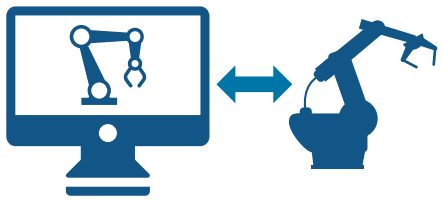


Engineering Systems are Multidomain, so curricula should be as well

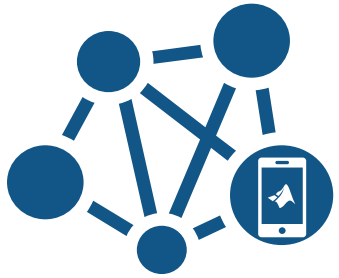


Aerospace | Mechanical | Electrical | Computer | Chemical | Civil | Environmental

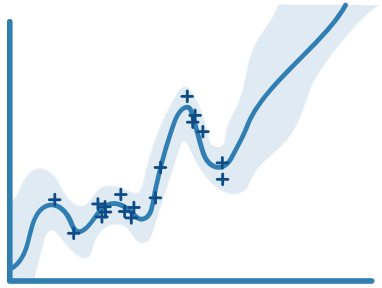
Emerging Trends for Multidomain Engineering Systems



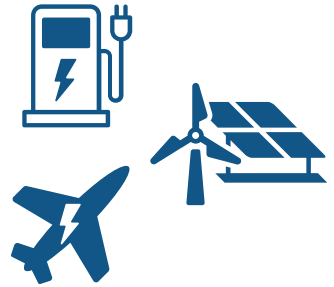
Robotics



Connectivity



Artificial Intelligence



Electrification

MathWorks collaborates with engineering education institutions to address these trends in curriculum.

Teaching Using Self-Paced Online Courses

Professional Skills Development is Enhanced by Interdisciplinary Curricula

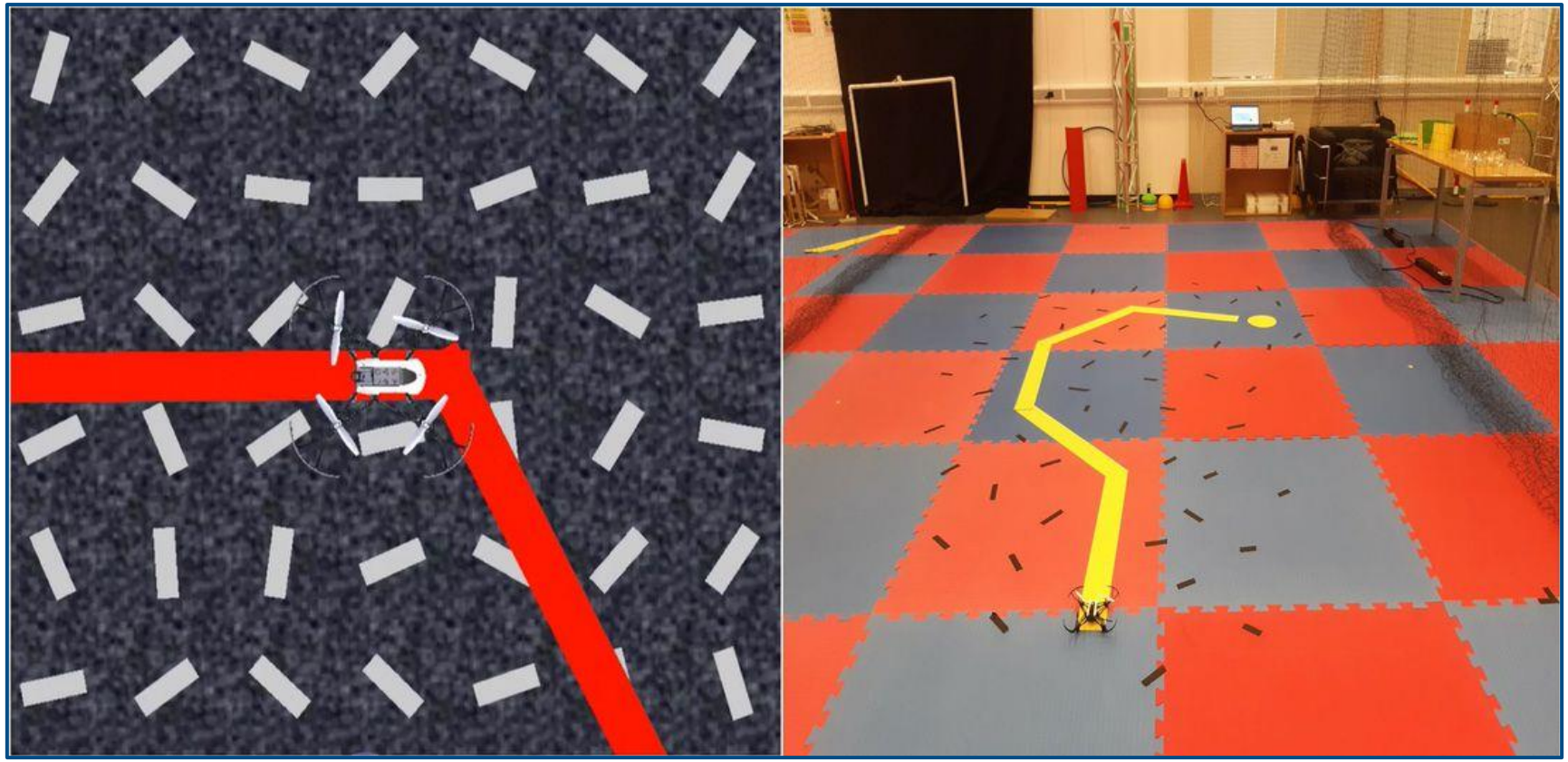
Critical Thinking

Teamwork

Project Management

Communication

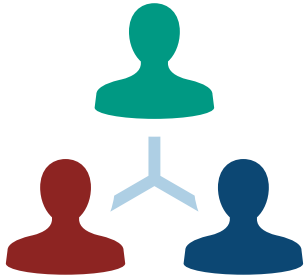
University of West of England – Avionics and Controls Lab



Supported Course Design: Incorporated a drone-based competition into an Avionics course.

New to the course: Team-based curriculum, developing and deploying image processing algorithms.

CURRICULA



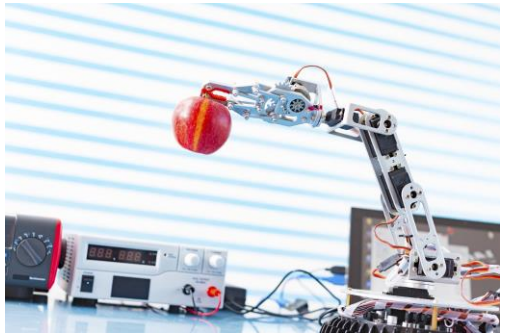
COLLABORATION

DIGITALIZATION

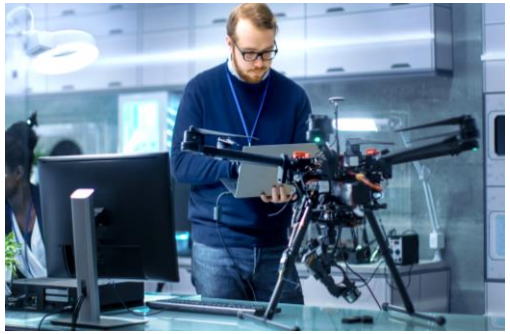
Inter-Department Collaboration

Reinforce Concepts

Applying theory

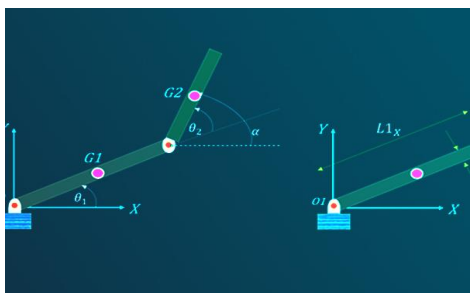


Project-based Learning



Multi-domain Systems

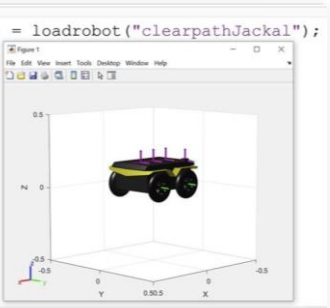
Department Collaboration: Robotics Example



Robot Kinematics

Robot Controls

```
[robot, info] = loadrobot("clearpathJackal");
show(robot);
```



Robot Algorithms

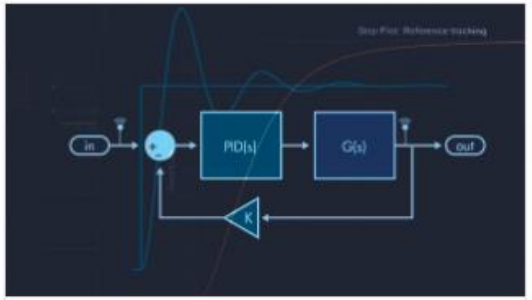
Robot Applications

MathWorks Provides Multi-Domain Content to Assist Teaching and to Prepare Students

Modeling Multibody Mechanical Systems with Simscape

Learn to model multibody mechanical systems; create custom geometries and compound bodies; assemble, guide, and verify mechanisms; and import CAD files.

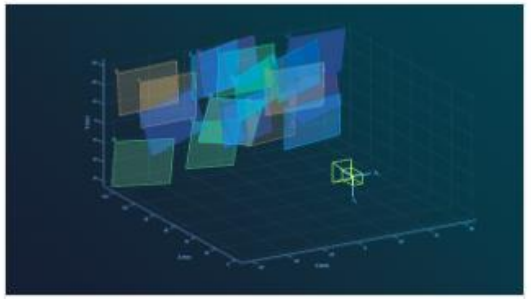
Robot Kinematics



Control System Design with Simulink

Learn to design and model control systems with Simulink. Topics include system identification, parameter estimation, control system analysis, and response optimization.

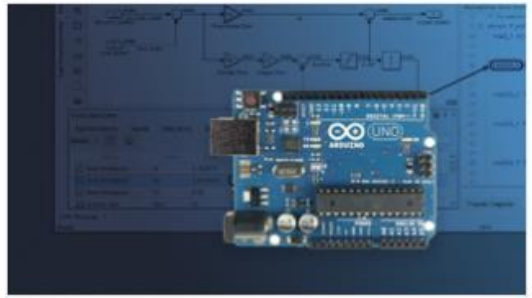
Robot Controls



Computer Vision with MATLAB

Learn to perform object detection, tracking, and motion estimation on images and videos. The course also covers camera calibration, point clouds, and 3D reconstruction.

Robot Algorithms



Embedded Coder for Production Code Generation

Develop Simulink models for deployment in embedded systems. Topics include code structure and execution, code generation options and optimizations, and deploying code to target hardware.

Robot Applications

Excellence in Innovation: Capstone Projects/ Thesis

Deep Learning for UAV Infrastructure Inspection

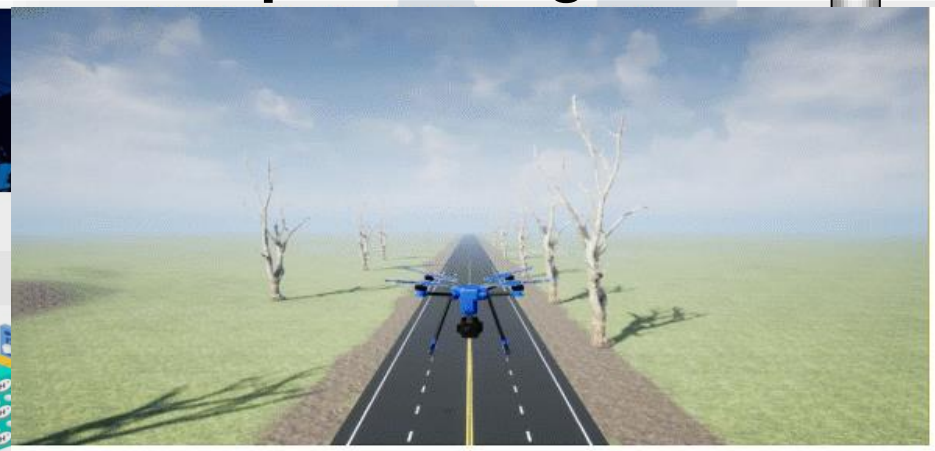
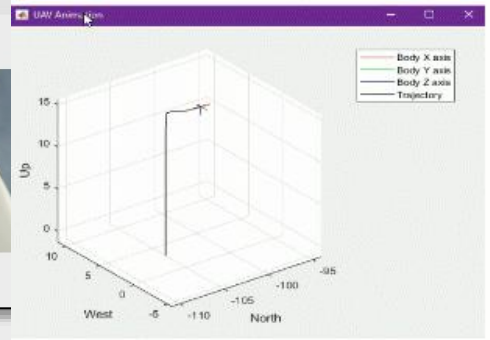
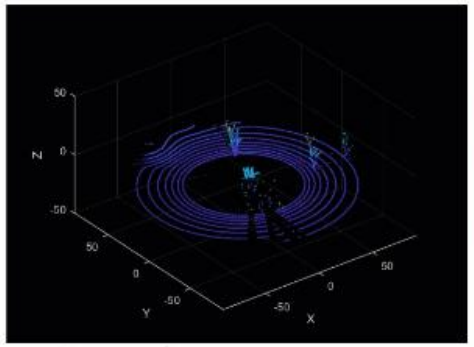


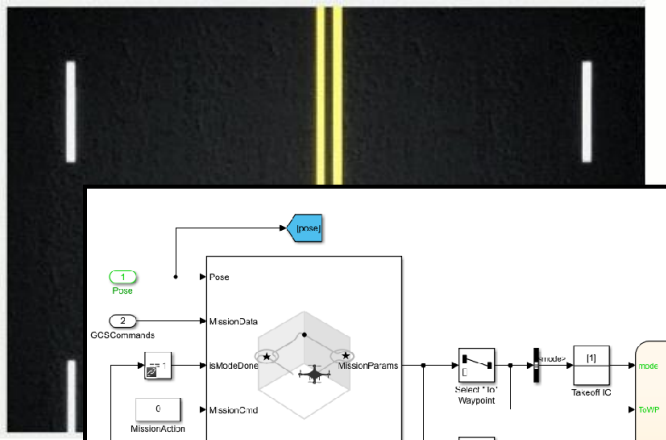
Photo Realistic Simulation



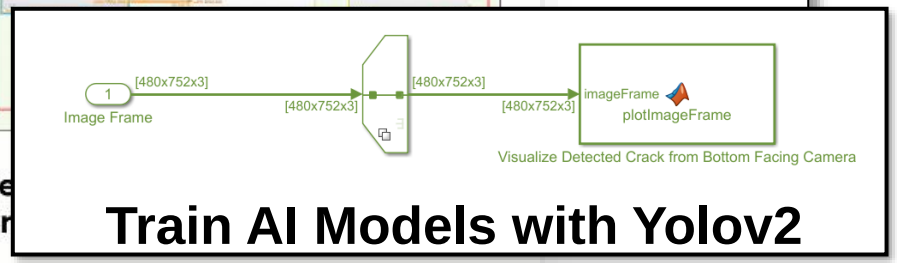
Low Fidelity Animation



Virtual Lidar Sensor



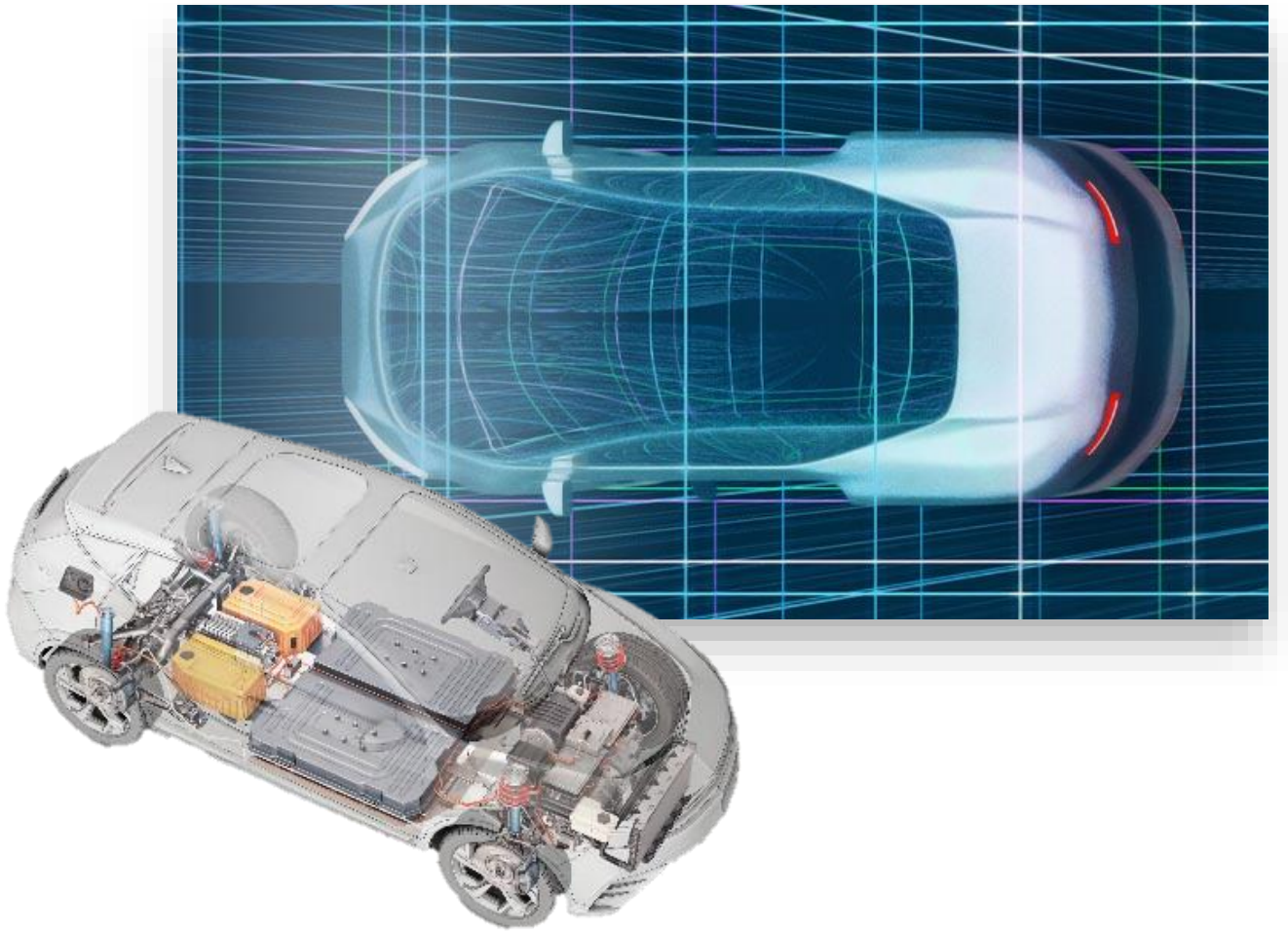
Create Controls in Stateflow



Train AI Models with Yolov2

Bosch and National Institute of Technology Calicut Collaborate on EV Course to Prepare Students for Industry

> "The collaboration between NIT Calicut, MathWorks, and Bosch narrowed the gap between academia and industry, producing an electric vehicle system engineering course that has been both well received by our students and highly useful for them as well."
>
> — *Dr. Kumaravel Sundaramoorthy, NIT Calicut*



Academia and industry partner to make students automotive-ready

Automotive

edX
Electric and Conventional Vehicles
Chalmers University of Technology

edX
Hybrid Vehicles
Chalmers University of Technology

edX
Model-Based Automotive Systems Engineering
Chalmers University of Technology

edX
Multi-Object Tracking for Automotive Systems
Chalmers University of Technology

edX
Sensor Fusion and Non-linear Filtering for Automotive Systems
Chalmers University of Technology

Learn Relevant Industry Tools

Why MATLAB and Simulink?

Millions of engineers and scientists worldwide use MATLAB and Simulink.

100,000+ business, government, and university sites

The top 10 auto manufacturers[1]

[1] OICA: *2016 World Motor Vehicle Production*

All of the top 10 aerospace companies[2]

[2] PwC: *Aerospace and Defense 2017 Year in Review*

Three of the top five internet companies

Find Ready Workforce

Sr. PHY Design Verification Engineer

Summary

Posted: **Jan 23, 2023**
Role Number:**200458042**

Would you like to join growing wireless silicon development team? Our wireless SOC organization is responsible for all aspects of wireless silicon development with a particular emphasis on highly energy efficient design and new technologies that transform the user experience at the product level, all of which is driven by a world-class vertically integrated engineering team spanning RF/Analog architecture and design, Systems/PHY/MAC architecture and design, VLSI/RTL design and integration, Emulation, Design Verification, Test and Validation, and FW/SW engineering.

In this highly visible role, you will be at the center of a silicon design group with a critical impact on getting functional wireless products to hundreds of millions of customers quickly.

Key Qualifications

- BS and 10+ years of relevant industry experience.
- Work closely with system/design team to review and understand PHY subsystem microarchitecture, create verification plans from specifications.
- Build block/subsystem level test benches with reference model, using best in class DV methodology. Architect test benches with maximum reusability in mind.
- Develop and execute both directed and constrained random tests, debug failures, manage bug tracking, and work with designers to drive closure of issues found.
- Create and analyze block/subsystem level coverage model, and add test cases to increase coverage.
- Support PHY subsystem validation using Palladium and/or FPGA.
- Work with team members to improve methodology and flow.

Description

- Verification experience of wireless/wired communication block/subsystem.
- Excellent knowledge and experience of ASIC verification flows including test bench development,

Experience of using Matlab/C reference model and bit-accurate verification a plus.

- Knowledge of wireless protocols such as Bluetooth, WLAN, or Zigbee a plus.
- Proficient in shell and Perl scripting, Python skills a plus.
- Experience of Palladium/FPGA validation a plus.
- Should be a team player with excellent communication skills, self-motivated and well organized.

Modeling/Simulation Design Engineer,

What You'll Bring

- BS in Electrical Engineering, Mechanical Engineering, Mechatronics, or equivalent of experience and evidence of exceptional abilities.
- 3+ years' experience with controls system development, modeling, and implementation.
- Excellent background in linear systems analysis, stability, and controller design.
- Creating dynamic models of electrical, mechanical, and thermal systems.
- Experience, understanding, and intuition for the physics of basic electric propulsion, motion control systems, and heat transfer.
- Knowledge in control systems including, spring loaded inverted pendulum, Zero Momentum Control, Model Predictive Control, Motor controls, etc.
- Modeling knowledge in inverse kinematics, inverse/forward dynamics, impedance control, torque control, etc.
- Basic design of electric motors & power electronics & control circuits.
- Familiar with gear reduction mechanisms including: Planetary, Belt drives, Harmonics Drives, Magnetic Gears, etc.
- Strong mechanical skills, including design, manufacturing limits, mechanical linkages, design for

Strong programming skills in Matlab/Simulink, Python, C++, SQL, etc.

- Strong skills in CAD (CATIA, NX, Inventor, Solid Works, etc.)

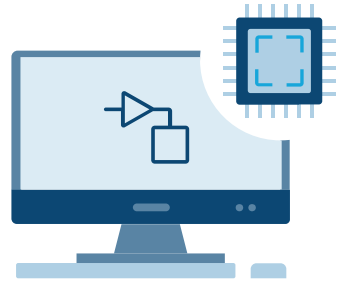
Student Experience: Transitioning to Industry

"This high-level, abstract understanding of complex systems is a skill set that is highly sought after in the automotive industry these days." ***Joe Martin, former University of Michigan student***

"They were confident that I had the knowledge to excel in the position because the tasks I completed in EcoCAR were almost the same tasks that full-time controls engineers do." ***Jessica Britt, former Georgia Institute of Technology student***

CURRICULA

COLLABORATION

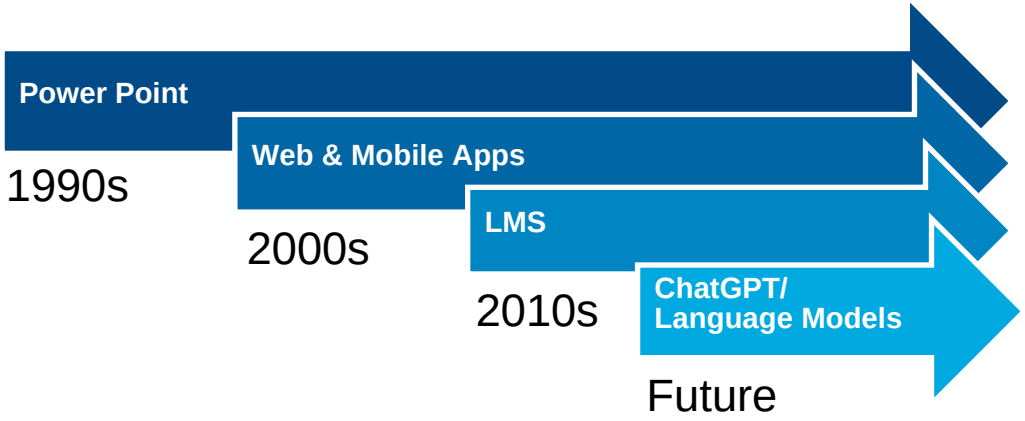


DIGITALIZATION

Digitalization in Engineering Education

Digital Skills for Students

Digital Tools for Teaching and Learning



MathWorks Enables Digital Skills in Students

Solutions

Search MathWorks.com

Automated Driving Systems
Design, simulate, and test automated driving systems

Computational Biology
Analyze, visualize, and model biological data and systems

Control Systems
Design, test, and implement control systems

Data Science
Explore data; build machine learning models; do predictive analytics

Deep Learning
Data preparation, design, simulation, and deployment for deep neural networks

Electrification
Develop electrical technology from components to systems

Embedded Systems
Design, code, and verify embedded systems

Enterprise and IT S
Use MATLAB with your

FPGA, ASIC, and S Development
Automate your workflo algorithm development design and verification

Image Processing Computer Vision
Acquire, process, and a and video for algorithm system design

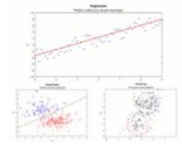
Internet of Things
Connect embedded de Internet and gain insigh

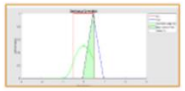
Machine Learning
Train models, tune para deploy to production or

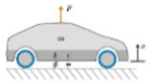
Mechatronics
Design, optimize, and verify mechatronic systems

communications systems

Modular Courseware

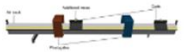

Machine Learning


Convolution


Mass-Spring-Damper

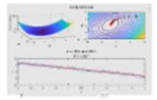

Vectors

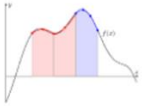

Statistics


Lab: Air Track


Qualitative Analysis of ODEs


Dynamic Systems


Regression


Numerical Integration

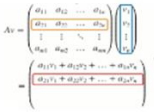
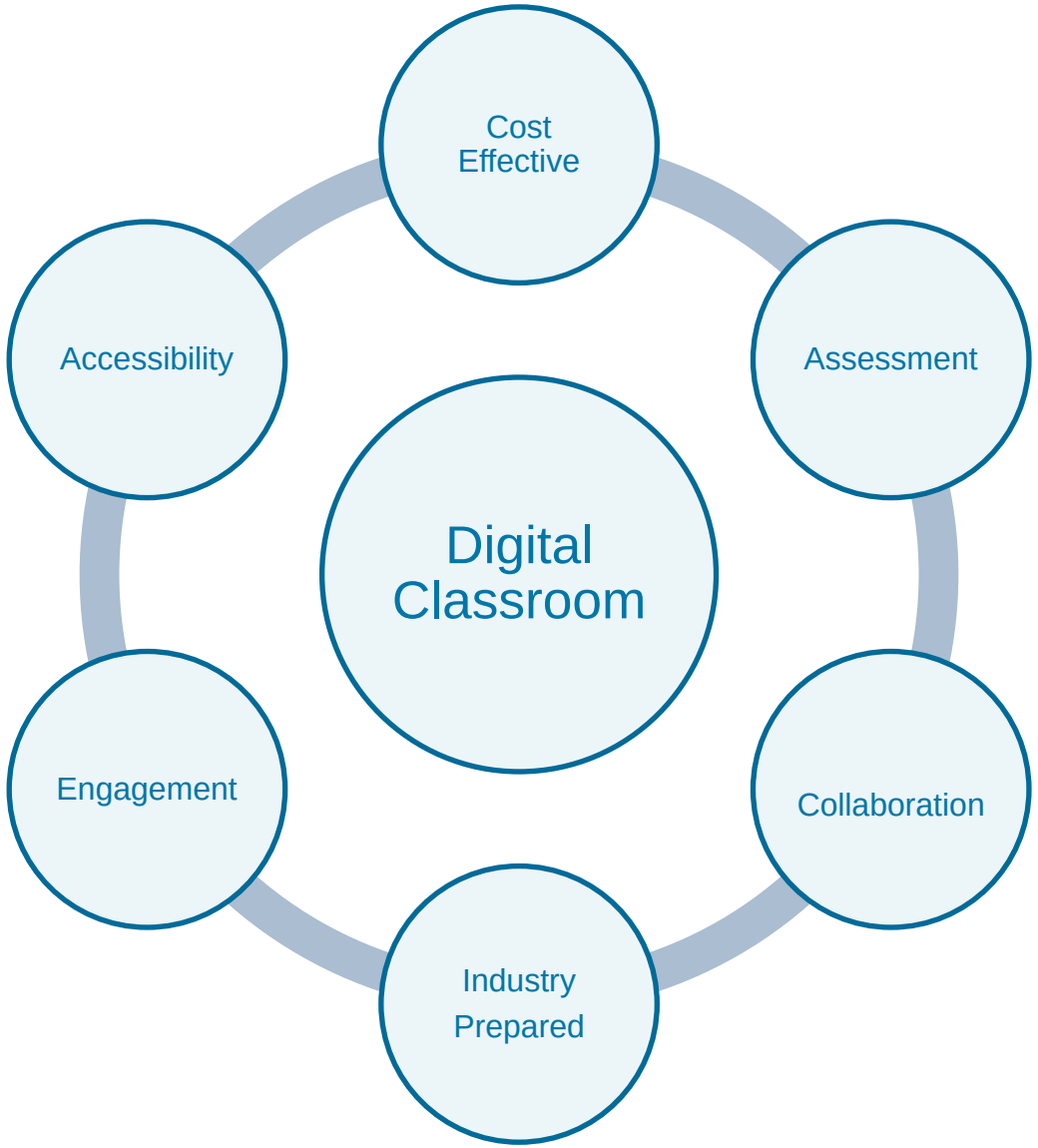

Matrix Methods


Image Processing


Lab: Virtual e/m Measurement

github.com/MathWorks-Teaching-Resources

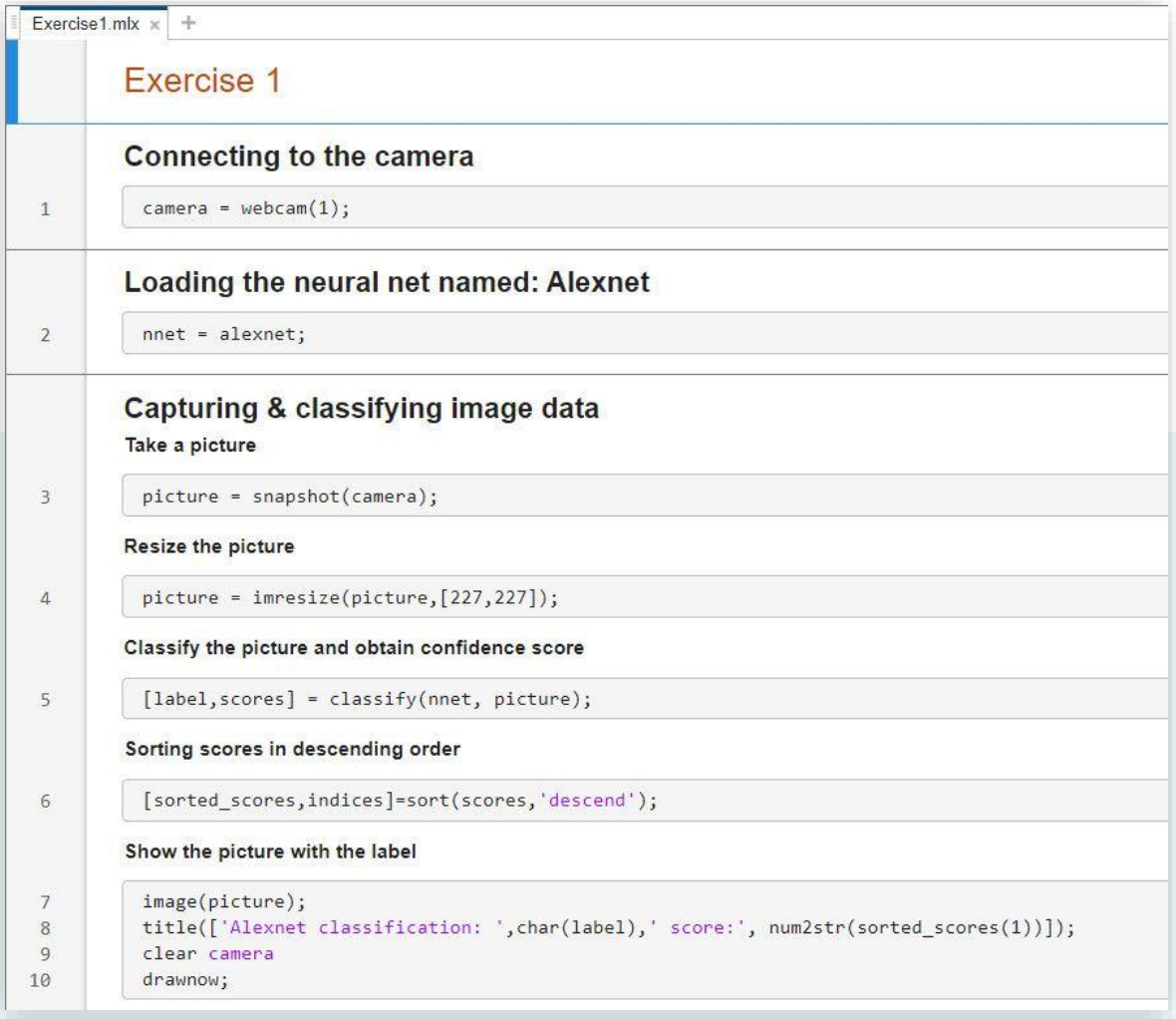
Effects of Digital Tools on Teaching and Learning



Arizona State University: AI and IoT for First-Year Students

New computing exercises for First-Year Engineering:

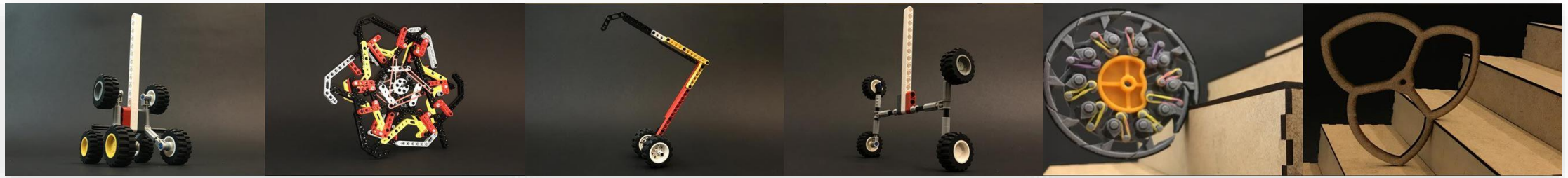
- **Artificial Intelligence**
- **Internet of Things**



"When I started teaching Introduction to Engineering, there were just a handful of female students. Today, about a quarter of the class is female. Activities like the deep learning and IoT module, which seems appealing to female students, are likely to encourage them to continue in the engineering program."

- Chao Wang, PhD, Arizona State University

Students at ETH Zurich Develop a Jumping Robot for Final Project

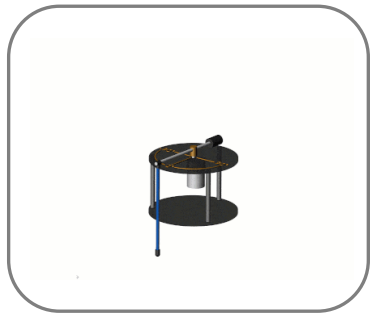


- Students evaluated basic movement of 20 designs using MATLAB
- Tuned and deployed a balancing algorithm to a prototype robot

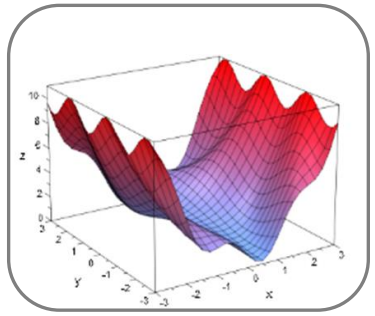
Effects of Digital Tools on Teaching and Learning

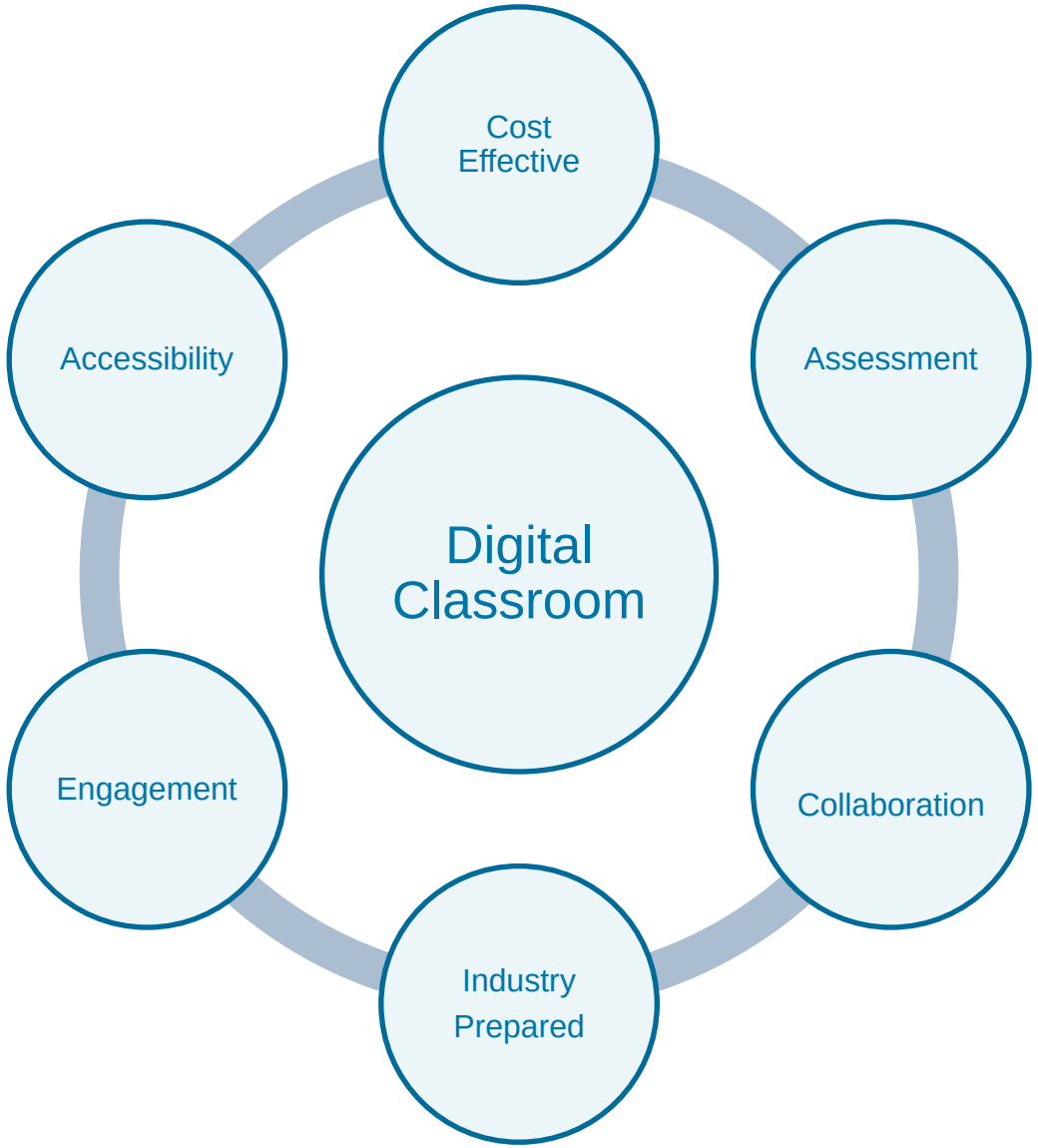
MATLAB Online

Virtual Labs



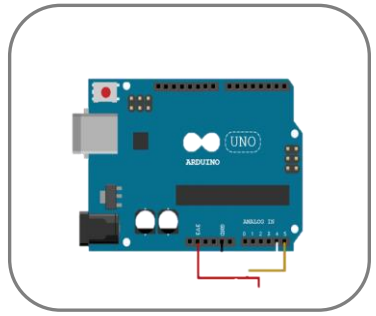
MATLAB Live Scripts





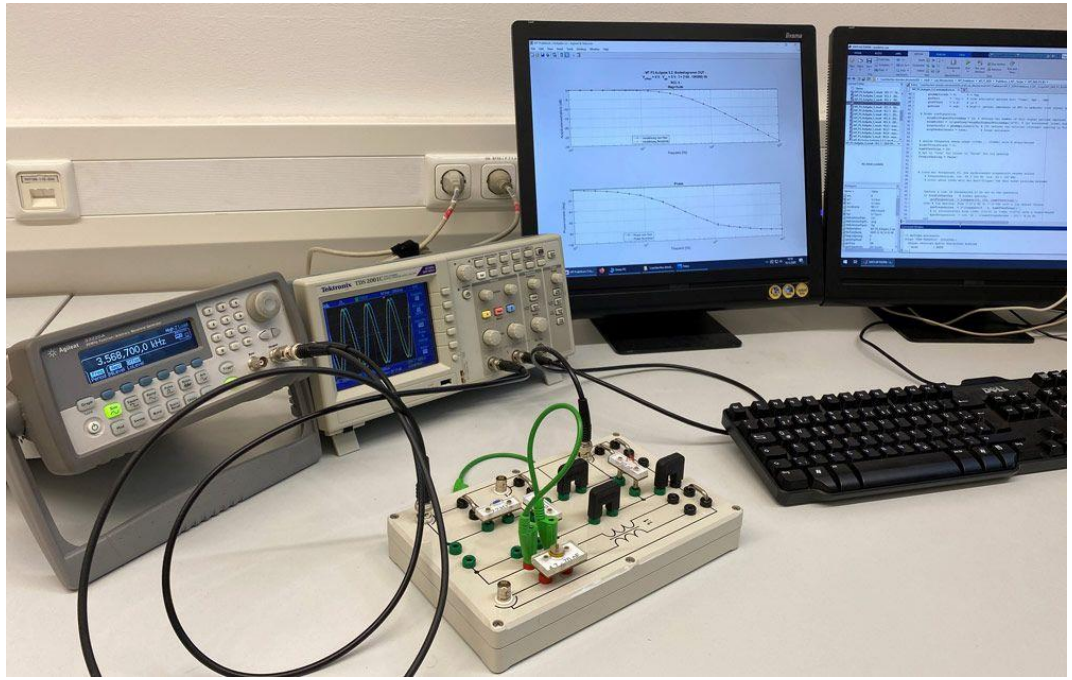
MATLAB Online Courses

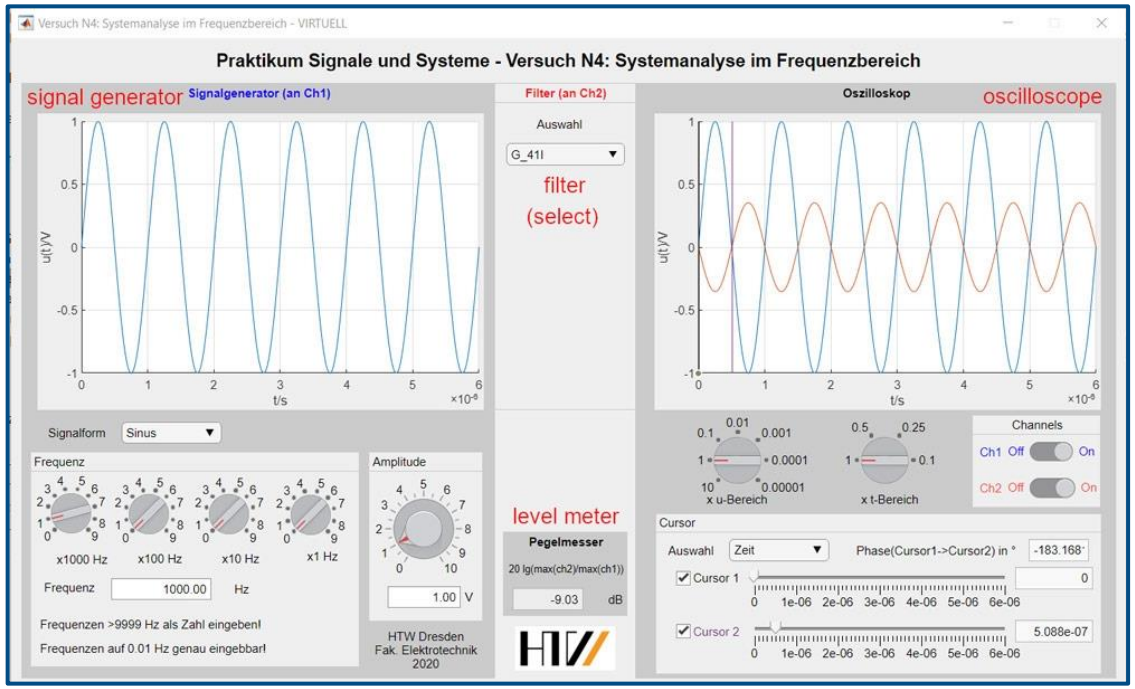
MATLAB Grader



Project Based Learning

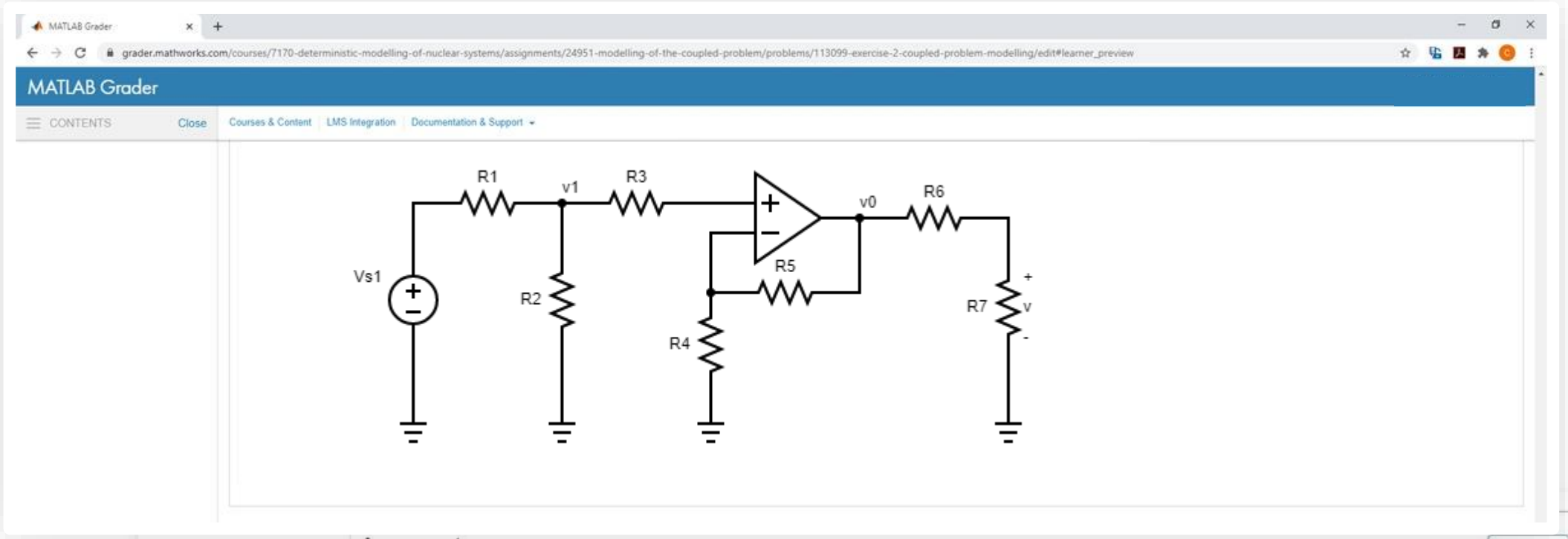
HTW Dresden:
Converting a Physical Lab to a Virtual Teaching Lab

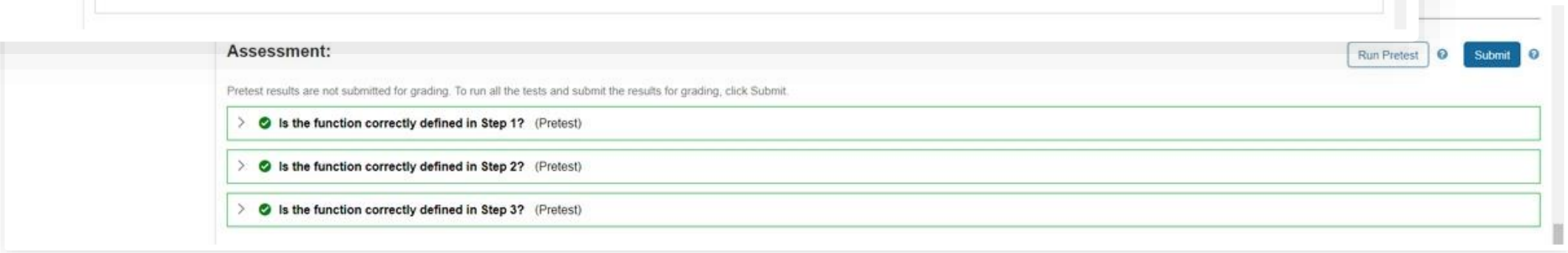




- App created to simulate signal generator, oscilloscope, and tunable filters.
- Used as a standalone virtual lab and as an extension of the physical laboratory time.

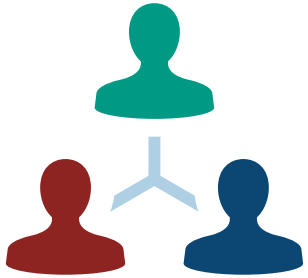
Teaching and Automatic Grading with MATLAB Grader



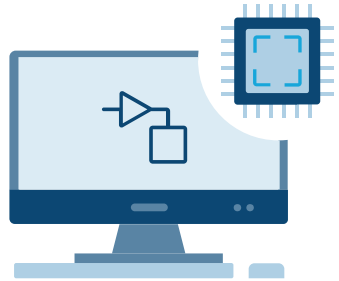


Opportunities

CURRICULA



COLLABORATION



DIGITALIZATION

Considerations for an Engineering Educator

Consideration for an Engineering Educator

Student

Project Based Learning

All

Examples on Trending Topics

Dean

MATLAB Grader

Learning Center

MATLAB Online Courses

Research Groups

Tools to Teach or Research

Corporate Relations

Student Competitions

Industry

Industry Standard Tools

MATLAB EXPO

Thank you