**APPLICATION PROCESS**

- Application details are available under the “Apply Now” tab at [http://mocha-java.uccs.edu/IDEATE/](http://mocha-java.uccs.edu/IDEATE/)
- Students may also apply for a “GATE Fellowship” to help defray course costs (sponsored by DOE)
- For further information, please contact:
  Dr. Gregory L. Plett, Department of Electrical and Computer Engineering, University of Colorado Colorado Springs
  1420 Austin Bluffs, Colorado Springs, CO 80918-4012
  Voice: +1-719-255-3468; Fax: +1-719-255-3589; Email: gplet@uccs.edu

**ON-LINE AVAILABILITY**

- All Graduate-Certificate courses and most MSEE specialty courses are available on-line
- These offerings are very appreciated by working engineers and remote students from around the globe
- Course lecture materials and lecture video recordings available for access

**EDUCATING A WORKFORCE**

- Since program inception in 2012, more than 200 students have taken at least one IDEATE course
- As of May 2016, 16 students have completed the graduate certificate and 42 students have graduated with a specialty-area MSEE

**INTRODUCTION**

- IDEATE is a Department-of-Energy sponsored program jointly offered by three SELECT campuses that has:
  - Established a Graduate Certificate in Electric Drivetrain Technology that enables retraining “traditional” engineers in core electric-drivetrain topics
  - Established an MSEE option in Battery Controls and an MSEE emphasis area in Vehicle Power Electronics to educate a future workforce
  - Developed courses and materials that support fundamental PhD research, which will enable development of new technology in electric-drivetrain topics
  - Removed barriers to study by making coursework nationally accessible via on-line means and offering GATE Fellowships to qualified students to defray costs

**PROGRAM STRUCTURE**

- Graduate Certificate comprises four courses shared among the IDEATE campuses
- MSEE and PhD areas allow specialization in one particular topic area

**MODELING, SIMULATION, IDENTIFICATION OF BATTERY DYNAMICS**

- Models are sets of equations that describe how something operates
- Models of battery cells are needed when designing management algorithms
- This course first gives brief consideration to equivalent-circuit models and both their strengths and limitations
- Substantial attention is then given to deriving particle-scale homogeneous-phase physics-based models of internal cell dynamics
- Volume-averaging techniques are used to create continuum models
- Cutting-edge methods that automatically convert continuum models to high-fidelity reduced-order controls models are investigated in detail

**BATTERY MANAGEMENT AND CONTROL**

- A battery-management system monitors and controls usage of the battery pack
- This course begins with an overview of the major functions of a battery-management system
- In-depth consideration is then given to several methods for estimating battery state
- Voltage-based power-limit estimation methods are derived
- The course concludes with an introduction to optimized model-predictive controls for physics-based power-limit computation

**POWER ELECTRONICS FOR ELECTRIC DRIVE VEHICLES**

- Power electronics make up a critical portion of the electric drivetrain
- Power converters are needed for motor drives and battery chargers and other power-electronics subsystems are needed within the battery-management system
- This course first gives an overview of electric-drive vehicles, including system architecture and dynamic system modeling and simulation
- Power converters for motor drives are then introduced
- Power converters for battery-management electronics are covered
- Finally, the course studies power converters for battery chargers and utility interface

**ADJUSTABLE SPEED AC DRIVES**

- AC drives are both inexpensive and efficient but require careful control
- This course presents a unified treatment of complete electrical drive systems: mechanical load, electrical machine, power converter, and control equipment
- Emphasizes induction, synchronous, and permanent-magnet drives
- This course begins with an introduction to electric machines for electric vehicles
- It then looks at principles for analysis of electric machines, reference frame theory
- Uses simulation programs (e.g., SPICE, finite-element/difference program) to simulate drive-system components (e.g., gating, inverter, electric machine)