The Global Electric Drive and New Products Organization focuses on Analyzing, Designing, Testing and Validating the world's leading Electric Propulsion Systems for GM's EV / HEV applications. Our responsibilities include motor design, analysis and testing, power electronics specification, design and testing, and the design, development and testing of the software control algorithms and calibrations that bring the hardware to life.

Contacts:
Anthony Howard
Electrification Controls
anthony.howard@gm.com

General Criteria
Entry Level positions
Pending or Recent (< 1yr) graduate
GPA 3.5
Passport to work in the Automotive Industry
Must be Authorized to work in the USA. (No exceptions)
All positions are in Southeastern Michigan
Create your candidate profile at careers.gm.com
1) From top navigation menu, select Worldwide Locations -> North America -> United States
2) From United States navigation menu, select Search and Apply
3) Scroll down to Candidate Profile and click Update
4) Read and accept privacy statement, then register as New User
5) Click “Access my profile” and follow the prompts.

Your candidate profile must be completed in order for GM Talent Acquisition to follow up with you.

GENERAL MOTORS
ELECTRIC DRIVE AND NEW PRODUCTS ORGANIZATION
Career Opportunities

Development Validation Engineer - Electric Motors & Power Electronics

Responsibilities:
- Develop, coordinate, and oversee execution of validation activities for electric drive components and systems
- Track development and validation progress
- Author test procedures and ensure test safety (compact test systems)
- Analyze test data and develop test results
- Participate in critical test systems development
- Have a comprehensive understanding of the product

Qualifications:
- BSEE or equivalent
- Experience with basic statistics
- Good communications skills

Preferred Skills:
- Familiarity with ASME standards
- Experience with FMEA software

Development Validation Engineer - Electric Motors / Power Electronics

Responsibilities:
- Design and develop software for the control of electric drive components and systems
- Perform and optimize system and components design improvements
- Create and document procedures for testing and manufacturing
- Participate in critical test systems development
- Have a comprehensive understanding of the product

Qualifications:
- BSEE or equivalent
- Experience with basic statistics
- Good communications skills

Preferred Skills:
- Familiarity with ASME standards
- Experience with FMEA software

Electric Power Conversion Software Engineer

Description:
- Develop software-based control algorithms for electric drive components and systems
- Test and optimize control algorithms
- Generate software for digital control of high voltage power electronics
- Implement, integrate, and support software for power electronics systems

Qualifications:
- BSEE in Computer Science or Electrical Engineering
- Experience in software development
- Knowledge of control algorithms
- Experience with control software development

Mechanical Design Engineer - Electric Motors / Power Electronics

- Design and develop software for the control of electric drive components and systems
- Perform and optimize system and components design improvements
- Create and document procedures for testing and manufacturing
- Participate in critical test systems development
- Have a comprehensive understanding of the product

Qualifications:
- BSEE or equivalent
- Experience with basic statistics
- Good communications skills

Preferred Skills:
- Familiarity with ASME standards
- Experience with FMEA software

Software-in-the-loop Engineer

Description:
- Develop and verify software for the control of electric drive components and systems
- Perform and optimize system and components design improvements
- Create and document procedures for testing and manufacturing
- Participate in critical test systems development
- Have a comprehensive understanding of the product

Qualifications:
- BSEE in Computer Science, Electrical Engineering, Mechanical Engineering, or Mechanical Engineering
- Experience in software development and automated testing
- Familiarity with automotive and power electronics systems

Power Electronics Design Engineer

Description:
- Develop and verify software for the control of electric drive components and systems
- Perform and optimize system and components design improvements
- Create and document procedures for testing and manufacturing
- Participate in critical test systems development
- Have a comprehensive understanding of the product

Qualifications:
- BSEE in Computer Science, Electrical Engineering, Mechanical Engineering, or Mechanical Engineering
- Experience in software development and automated testing
- Familiarity with automotive and power electronics systems

Energy Modeling Systems Engineer

Description:
- Model, analyze, and design new electric power electronics systems
- Optimize the performance and efficiency of electric drive components and systems
- Develop and verify software for the control of electric drive components and systems
- Perform and optimize system and components design improvements
- Create and document procedures for testing and manufacturing
- Participate in critical test systems development
- Have a comprehensive understanding of the product

Qualifications:
- BSEE in Computer Science, Electrical Engineering, Mechanical Engineering, or Mechanical Engineering
- Experience in software development and automated testing
- Familiarity with automotive and power electronics systems
- Knowledge of electrical and mechanical systems design and simulation
announces a new DOE Traineeship Program for Hands-On Experiences with Wide Bandgap Power Electronics

Details:
• Fellowships available for M.S. or Ph.D. students
• Pay is $30,000 / year plus tuition waiver
• Six new fellowships are available starting Fall 2016
• Applicants must be U.S. citizens

Power Electronics Labs: Open House, Friday, Nov. 20th ~12:00

Basic Magnetics Relationships

Fundamentals of Power Electronics

Chapter 13: Basic Magnetics Theory
**Electric/Magnetic Duals**

![Diagram showing electric and magnetic fields](image)

**Faraday’s Law**

\[ v = \frac{\Phi}{c} = \oint \frac{dB}{dt} dA = \frac{d\Phi}{dt} \]

- Voltage \( v(t) \) is induced in a loop of wire by change in the total flux \( \Phi(t) \) passing through the interior of the loop, according to:
  \[ v(t) = \frac{d\Phi(t)}{dt} \]

- For uniform flux distribution, \( \Phi(t) = B(t)A_c \) and hence:
  \[ v(t) = A_c \frac{dB(t)}{dt} \]

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*Fundamentals of Power Electronics 8  Chapter 13: Basic Magnetics Theory*
**Lenz’s Law**

The voltage $v(t)$ induced by the changing flux $\Phi(t)$ is of the polarity that tends to drive a current through the loop to counteract the flux change.

**Example: a shorted loop of wire**

- Changing flux $\Phi(t)$ induces a voltage $v(t)$ around the loop.
- This voltage, divided by the impedance of the loop conductor, leads to current $i(t)$.
- This current induces a flux $\Psi'(t)$, which tends to oppose changes in $\Phi(t)$.

**Ampere’s Law**

The net MMF around a closed path is equal to the total current passing through the interior of the path:

$$\oint_{\text{closed path}} \mathbf{H} \cdot d\mathbf{l} = \int_{\text{interior}} \mathbf{B} \cdot d\mathbf{A} = n \cdot i(t)$$

**Example: magnetic core. Wire carrying current $i(t)$ passes through core window.**

- Illustrated path follows magnetic flux lines around interior of core.
- For uniform magnetic field strength $H(t)$, the integral (MMF) is $H(t)l_m$. So $F(t) = H(t)l_m = i(t)$.
Core Material Characteristics

\[ B = \mu_0 H \]

\[ \mu_0 = \text{permeability of free space} = 4\pi \cdot 10^{-3} \text{Henries per meter} \]

Highly nonlinear, with hysteresis and saturation

Units

<table>
<thead>
<tr>
<th>Quantity</th>
<th>MKS</th>
<th>Unmagnetized cgs</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Gauss</td>
<td>Oersted</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Weber</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \Phi )</td>
<td>1T = 10^5 G</td>
<td>1A/m = 4\pi \cdot 10^{-3} Oe</td>
<td></td>
</tr>
</tbody>
</table>
**Inductor Example**

**Simplifying Assumptions:**

1. \( n \gg 1 \Rightarrow n \approx 1 \)  
   - All flux stays within the core
2. \( H \& B \) fields are confined within the core material
3. Linearized \( B \)-v-s- \( H \) relationship

**Faraday's Law:**

\[ n \frac{dB(t)}{dt} \]

**Ampere's Law:**

\[ \mu(H) \frac{dI}{dt} = n \cdot i(t) \]

**Core Characteristics:**

\[ B(t) = \begin{cases} 
  \frac{\mu_0 H(t)}{n} & \text{if } |B(t)| > B_{\text{sat}} \\
  B_{\text{sat}} otherwise & \text{(unaturated)}
\end{cases} \]

**Equations:**

\[ v(t) = n A c \frac{d}{dt} \left( \frac{\mu H(t)}{n} \right) \]

\[ v(t) = n A c \frac{d}{dt} \left( B(t) \right) \]

\[ v(t) = n A c \frac{d}{dt} \left( \frac{\mu_0 H(t)}{n} \right) \]