**Introduction to the Drifting Dynamo EML Project**

*In this project: Students analyze and design three dimensional static loading forces of an aloft wind turbine. The design is performed within a complex context, requiring technical, societal, and economic considerations.*

While statics is the study of stationary objects, this class gets students moving on their path to thinking like engineers! Most students begin their statics course excited to start their core engineering curriculum, but many have little to no idea about the ways in which statics will help them become engineers. They are often unsure how the course will be different from introductory physics, or why they are spending a whole course learning about things that don’t even move. However, statics is so much more than learning the fundamentals of defining forces as vectors and applying equations of equilibrium. It’s the course where students start seeing the world through the lens of mechanical engineers. …

Introductory engineering courses typically include iterative design approaches and decision-making tools. Design skills are often taught isolated from rigorous technical skills, causing students to think of skills as separate entities. When design is integrated into technical courses, students learn that their technical decisions significantly influence the larger design. Consequently, by integrating this EML into your course, you can give your students the opportunity to balance engineering requirements with social and financial impacts when developing infrastructure in a community.

3D particle equilibrium is one of the first techniques that you will likely cover in your course. In its most theoretical form, 3D particle equilibrium applies several known force vectors at a single point in space. An analysis of a problem involves the following steps shown in Figure 1:

1) Determining a point where all forces act

2) Drawing a free-body diagram showing all of the forces acting at this point

3) Calculating position vectors for all forces

* + **r**BA=**r**A-**r**B where rA={Ax**i**+Ay**j**+Az**k**} and rB={Bx**i**+By**j**+Bz**k**}

4) Calculating unit vectors

* + **u**BA=$\frac{r\_{BA}}{r\_{BA}}$ where rBA = $\sqrt{(A\_{x}-B\_{x})^{2}+ (A\_{y}-B\_{y})^{2}+(A\_{z}-B\_{z})^{2}}$

5) Writing applied and constraining force vectors in terms of their unit vectors and magnitudes

* + **FBA**=FBA**u**BA

6) Applying equations of equilibrium

* + $\sum\_{}^{}F=0=F\_{BA}+F\_{AC}+F\_{EA}+F\_{AF}+F\_{AG}$

7) Calculating unknown forces

You may have used this theoretical vector analysis to solve example problems such as suspending traffic lights or potted plants. However, if you want your students to see an even bigger picture and connect with the course content, this EML is for you! By integrating an EML-based project into one of their first core engineering courses, students learn from the get-go that engineering is not an exact, straightforward process. There are high levels of complexity that require the integration of a broad range of skills.