



# Instructor Guide

## Basic principle of motor generator operation

Developed and curated by the Ansys Academic Development Team

Angelos Fragkos and Dimitris Tzagkas

[education@ansys.com](mailto:education@ansys.com)

This instructor guide can be used to implement the module “Basic principle of motor generator operation” in the classroom.

### 1. Module Aim

The aim of this module is to support the introduction of Electromotive force (EMF) and the basic principle of motional generation of EMF that generators are based on. The resource contains several different files to cover the theory as foundation, followed by tutorials to create an example in Ansys Maxwell® tool, the advanced electromagnetic field solver.

### 2. Contents of resource and usage guidelines

The contents of this resource are outlines as below:

File “01\_Theory\_EMF” contains the electromotive force theory related to electric machines. The estimated time for a lecture presentation and explain the theory is 30-40 minutes.

File “02\_DesignCreation\_EMF” contains lab tutorial to create a setup of magnets and wire loop as a basic electric machine. The estimated time required for design creation is ~30 minutes by an undergraduate student.

File “03\_MagnetostaticAnalysis\_EMF” contains lab tutorial to analyze the setup and plot the fields. The estimated time for applying the instructions is less than 15 minutes. Analysis time is estimated <5 minutes for a medium performance laptop/computer.

File “04\_TransientAnalysis\_EMF” contains lab tutorial to create the setup of rotating the magnets of the design and plotting the electromotive force generated on the wire loop. The estimated time for applying the instructions is about 20 minutes. Analysis time is estimated ~30-50 minutes for a medium performance laptop/computer.

In the teaching package the design is included as well with the magnets structure alone (“North\_South\_Poles.aedt”) and additional the complete design including the results after being solved fully (“North\_South\_Poles\_solved.aedt”).

### 3. Applicable courses

The current resource is applicable to electronics engineering courses such as electromagnetics fundamentals, electric machines, electromechanics, electric generators and electric motors.

© 2025 ANSYS, Inc. All rights reserved.

## Use and Reproduction

The content used in this resource may only be used or reproduced for teaching purposes; and any commercial use is strictly prohibited. The full Academic Terms & Conditions can be found [using this link](#).

## Document Information

This case study is part of a set of teaching resources to help introduce students to topics related to fluids.

## Ansyes Education Resources

To access more undergraduate education resources, including lecture presentations with notes, exercises with worked solutions, microprojects, real life examples and more, visit [www.ansys.com/education-resources](http://www.ansys.com/education-resources).

## Feedback

Here at Ansys, we rely on your feedback to ensure the educational content we create is up-to-date and fits your teaching needs.

[Please click the link here](#) out a short survey (~7 minutes) to help us continue to support academics around the world utilizing Ansys tools in the classroom.

**ANSYS, Inc.**  
Southpointe  
2600 Ansys Drive  
Canonsburg, PA 15317  
U.S.A.  
724.746.3304  
[ansysinfo@ansys.com](mailto:ansysinfo@ansys.com)

If you've ever seen a rocket launch, flown on an airplane, driven a car, used a computer, touched a mobile device, crossed a bridge or put on wearable technology, chances are you've used a product where Ansys software played a critical role in its creation. Ansys is the global leader in engineering simulation. We help the world's most innovative companies deliver radically better products to their customers. By offering the best and broadest portfolio of engineering simulation software, we help them solve the most complex design challenges and engineer products limited only by imagination.

visit [www.ansys.com](http://www.ansys.com) for more information

Any and all ANSYS, Inc. brand, product, service and feature names, logos and slogans are registered trademarks or trademarks of ANSYS, Inc. or its subsidiaries in the United States or other countries. All other brand, product, service and feature names or trademarks are the property of their respective owners.

© 2025 ANSYS, Inc. All Rights Reserved.