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**Gear Systems Design for Minimum Noise**

**INSTRUCTOR:**

**Raymond Drago, P.E.**

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| **COURSE INFORMATION** |

**Course Description**

The need for noise control and its relation to gear drive design will be discussed. The general nature of noise and its measurement will be examined, with particular emphasis on terminology standards, and units of measurement appropriate to gear technology. Gear noise, per se, is seldom heard by and observer. The mechanism by which observer noticed noise is generated and transmitted will be defined, described, discussed.

Before attempting to solve a noise problem with an existing unit or beginning the design of a new unit, the nature of the noise must be defined. Both experimental and analytical methods will be covered, with particular emphasis on application rather than theory.

The many factors that influence the noise produced by a gear system will be discussed. The relative effects of each factor will be studied qualitatively. Factors to be considered include gear tooth geometry and accuracy, speed, materials, housing design, bearing type, gear type, air entrapment, root clearance, interference alignment, surface finish, and phasing.

Although, ideally, the designer should solve noise problems on the drawing board, in the real world this sometimes does not occur. Various techniques that can reduce the noise level of existing gear systems without requiring major hardware replacement will be presented and discussed. Included in the discussion will be enclosures, absorbers, dissipative dampers, isolators (gearbox and gear blank), and impulse phasing.

**It is recommended that you spend a minimum of 1 hour reading and reviewing the material each day.**

**Course Rationale/Students Course Designed to Serve**

Gear and gearbox design and quality control engineers involved with design and manufacture of gear systems used in applications where noise is of special concern such as medical equipment, electric vehicles, and any other application where the level and/or character of the noise emitted by the gear system is of significant concern.

**Learning Objectives**

* Understand the need for gearbox system noise control and, especially, the difference between “**gear** noise” and “gearbox **system** noise”
* Become familiar with the “nature” of noise and its measurement as well as terminology standards, and units of measurement appropriate to gear technology
* Learn the mechanisms by which observer noticed noise is generated and transmitted
* Gain a knowledge of the experimental and analytical methods for measuring noise, with particular emphasis on application rather than theory.
* Explain the importance of equal planet/star gear spacing and how a system can be designed with unequal planet spacing.
* Understand the various design and manufacturing factors that influence gear system noise including gear tooth geometry and accuracy, speed, materials, housing design, bearing type, gear type, air entrapment, root clearance, interference alignment, surface finish, and phasing.
* Recognizing that it is often necessary to address noise issues after the gearbox system is designed, learn how enclosures, absorbers, dissipative dampers, isolators (gearbox and gear blank), and impulse phasing can be applied to existing systems to reduce noise level.

**Required Textbooks (Provided by AGMA)**

AGMA’s *Gear Systems Design for Minimum Noise* by Raymond J. Drago

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| **STUDENT FEEDBACK AND GRADING PROCEDURES** |

**Assignments**

Assignments and learning activities are given and directed at the discretion of the instructor.

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| COURSE MANAGEMENT |

**Weather Delays and Cancelations**

We will communicate any cancellations, delays or other concerns for safety prior to class via email, voicemail, and/or text message. Please be sure that we have all pertinent contact information as you travel to your class location.

**Attendance for Domestic and International Students**

Please be mindful that these are short, accelerated courses. Attendance is extremely important. If you are going to be absent from any class day, please contact the course coordinator.

**Plagiarism, Cheating and other types of Misconduct**Plagiarism[[1]](#footnote-1), cheating and other types of misconduct are unacceptable.

**Students with Disabilities**Students requiring assistance and accommodation should complete the [Special Accommodation Request form](http://www.graduateschool.edu/images/stories/AcademicPrograms/AdmissionsApplicationGuideD3.pdf) and submit it to Stephanie Smialek, Education Manager at [smialek@agma.org](mailto:smialek@agma.org). She can be reached at 773-302-8026.

**Grievance Procedures**Students who have concerns about the class are encouraged to contact Stephanie Smialek, Education Manager, at [smialek@agma.org](mailto:smialek@agma.org) or 773-302-8026.

**Outline Changes**The instructor reserves the right to modify the outline during the course of the class.

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| LEARNING AND OTHER RESOURCES |

**Links for writing resources:**

* grammar.ccc.commnet.edu/grammar
* [www.merriam-webster.com](http://www.merriam-webster.com)

**Links for Math resources:**

* [www.sosmath.com](http://www.sosmath.com)
* Khan Academy on www.youtube.com

**Links for time management, study skills and note taking resources:**

* [www.mindtools.com](http://www.mindtools.com)
* [www.testakingtips.com](http://www.testakingtips.com)

**Links for career resources:**

* <https://www.agma.org/newsroom/jobs/>

**Industry News**:

* https://www.agma.org/newsroom/industry-news/

1. Plagiarism is defined as “the use or close imitation of the language and thoughts of another author and the representation of them as one’s own original work.” [↑](#footnote-ref-1)