Automotive NVH Course Sequence

An Introduction to the 2007-08 Offering by

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Web Sites: [www.AutoNVH.org](http://www.AutoNVH.org), [www.SmartVehicleCenter.org](http://www.SmartVehicleCenter.org)

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Unique course sequence (developed by OSU and GM)
- 2 graduate engineering courses
- 1 math prep seminar
- 4 self-paced seminars on the cutting edge

Specialized one-year certificate program

NVH Course Sequence Offered by OSU in partnership with KAIST (Korea)
List of Courses and Certificate in Automotive NVH (CNVH)

**Prerequisite:** TEP012 Mathematical Preparation for NVH *(non-credit, self-paced seminar) (OSU)*

**Two graduate engineering courses:**
- ME777D Automotive NVH I (OSU) - 4 qtr credits
- ME778D Automotive NVH II (OSU) – 4 qtr credits

**Three non-credit, self-paced DVD seminars:**
- TEP020 Rubber and Hydraulic Mounts (OSU)
- TEP301 Driveline System NVH Issues (OSU)
- TEP302 Mid-Frequency Vib. Isolation (KAIST)
- TEP300 Acoustic Holography (KAIST)
Course, Degree or Certificate Options

**MS Degree Program (UM):** Take 1 or 2 graduate courses (NVH I & II)

**Certificate in NVH (CNVH):** Take graduate courses and seminars leading to the Certificate program offered by OSU/KAIST & GM

**Continuing Education:** take 1 or more courses or self-paced seminars on the cutting edge NVH topics
Schedule of the Courses (2007-08)

• **Prerequisite:**
  TEP012 Math Prep  
  (Summer/Fall 07)

• **Two graduate engineering courses:**
  ME777D NVH I  
  (Fall 07 – 11 Weeks)
  ME778D NVH II  
  (Winter 08 – 11 Weeks)

• **Three self-paced seminars**
  (Spring 08 or beyond)
Format of NVH I and II (Graduate Courses)

• 16 (90-min) taped in front of Live audience at OSU
• Class notes and tapes provided on DVDs + items posted on a secure course site
• 4 Webex conferences in each course: A. Guest lectures (by GM experts on current NVH issues, methods, or best practice) B. Help sessions on home work, exams & projects
• Home work assignments and take home exams – solutions require Matlab
• Group project (in NVH I and/or NVH II) on GM topics

Teaching Staff: Instructor + GM Course Moderator + Teaching Assistant at OSU + GM Mentors on projects
Objectives of the Automotive NVH Sequence

1. Provide a sequence of 3 (2 for General Motors) courses based on an innovative case study approach (this is similar to what has been done in business, law and medical schools).

2. Enhance critical thinking skills and relate NVH issues to design, manufacturing, material, performance, and economic considerations.

3. Integrate concepts of mechanical vibrations, acoustics, digital signal processing, and machinery dynamics into a cohesive graduate course sequence.
Course Philosophy

• Focus on the physics of vehicle components and systems, examine source(s)-path(s)-receiver(s)

• Characterize and simulate the governing (linearized) systems; predict modes and frequency response functions

• Identify key design factors, and propose noise & vibration control methods
Example: 3-D Mode Shape Display

Drivetrain Mode [29.5 Hz].

- Right Wheels & Vehicle
- Differential
- Driveshaft
- Left Wheels & Vehicle
- Engine
- Flywheel & Impeller
- Transmission
Example: Practical Issues & Problem Solving Steps

For a given NVH problem of your choice, identify the following:
- Name of the NVH problem _________?
- Sound quality/perception or vibration feel issues
- Source-path receiver network; critical components
- Frequency range; modes of interest; major phenomena
- If it is transient problem, identify time domain issues
- Test/measurement schemes and the format of results
- Specifications used (or desired); design or performance targets
- Benchmark vehicles/components; allocation or targeting issues
- Vibration & noise control strategies (band-aid vs. redesign)
- Cost of NVH solutions (money, mass, complexity, etc.)
- Effect of design and manufacturing variations
- Modeling issues (simplified, FEM/BEM, ADAMS, etc.)
- Miscellaneous (as relevant to your problem)
  - Consumer ratings, warranty, etc.
  - Legal/patent issues, customer relations and political issues, etc.
NVH Literature & Web Sites

- Acoustics and Vibration Animations by Dan Russell: [http://www.kettering.edu/~drussell/Demos.html](http://www.kettering.edu/~drussell/Demos.html)
- Prof. Singh’s web site: [www.AutoNVH.org](http://www.AutoNVH.org)
- Magazine: Sound & Vibration <www.sandv.com>
- Application notes from: B&K, HP, PCB, LMS, etc.
Summary – Courses and Schedule

• TEP012 Math Prep (seminar) (Summer/Fall 07)
• ME777D NVH I (Fall 07 – 11 Weeks)
• ME778D NVH II (Winter 08 – 11 Weeks)
• Three self-paced seminars (Spring 08 or beyond)

Options

Courses for MS Degree Program (UM)
Certificate in NVH (CNVH)
Continuing Education

• Go to www.AutoNVH.org for more details
• Contact Prof. Singh via <singh.3@osu.edu>