CE-851 Vibration Control of Structures

Code	Credit Hours	Category
CE-851	3 Credit Hours	Elective

Course Description:

This course covers various control strategies such as passive, active, semi-active and hybrid control, to reduce the excessive vibration of structures under natural hazards (i.e., earthquakes and strong winds) as well as man-made hazards. In addition, the state-of-the-art technologies such as smart material-based control are also introduced.

Text Book:

- *Structural Control: Past, Present, and Future*, Authors: Housner, GWea, Lawrence A. Bergman, T. Kf Caughey, Anastassios G. Chassiakos, Richard O. Claus, Sami F. Masri, Robert E. Skelton, T. T. Soong, B. F. Spencer, and James TP Yao. Journal of Engineering Mechanics, ASCE, 123(9), 1997.
- *Active Structural Control: Theory and Practice*. Authors: T.T. Soong, John Wiley & Sons, 1990.

Reference Books:

- Preumont (2011), "Vibration Control of Active Structures: An Introduction," Springer.
- H. L. Moud (2000), "Control of Vibrations and Noise," Wiley.
- *Passive Energy Dissipation Systems in Structural Engineering*. Authors: T.T. Soong and G.F. Dargush, John Wiley & Sons, 1997.
- *Active Control of Structures*. Authors: Andre Preumont, Kazuto Seto.
- *Passive Vibration Control*. Authors: Denys J. Mead, Wiley Publications
- *Principles of Vibration Control*. Authors: A. K. Mallik, Affiliated East-West Press, India.

Prerequisites:

BE (Civil, Architecture, Construction Engineering & Management).

Assessment System

Component	Weightage	Frequency	Comments
Quizzes	10-15%	2-3	Throughout the semester
Assignments	10-20%	2-3	Throughout the semester
Mid Terms	30-35%	1	Mid of semester

ESE	40-50%	1	End of semester
Project (optional)	10-15%	1	End of semester

Teaching Plan:

Week	Topics
1	Introduction/Overview
2	Passive control: Introduction, Steel damper, Friction damper
3	Passive control: Viscoelastic damper, Viscous damper,
4	Passive control: Tuned mass damper, Tuned liquid damper, Base isolation system
5	Passive control: Base isolation system
6	Passive control: Review
7	Active control: Introduction, Actuators
8	Active control: Control algorithms
9	**Mid Term Exam/ OHT, (As per NUST Exam Policy)**
10-11	Active control: Control algorithms, Review
12	Semi-active control: Introduction, MR damper
13	Semi-active control: MR elastomer Hybrid control: Introduction, Hybrid mass damper
14	Hybrid control: Smart base isolation
15	Smart material-based control: Shape memory alloys, Piezoelectric materials Semi-active/Hybrid/Smart material-based Control: Review
16	Presentations for Term-project
17-18	**ESE**

Software Tools

MATLAB, Seismosignal, Seismomatch, ARTeMIS