# STRUCTURAL CONTROL
# FALL 2016

INSTRUCTOR:

Mehdi Ahmadizadeh, Assistant Professor
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LECTURE HOURS:

Sun, Tue 7:30 – 9:00 am

OFFICE HOURS:

Sun, Tue 9:00 – 10:00 am

REFERENCES:

1. Christopoulos, C. and Filiatrault, A. 2006. 'Principles of Passive Supplemental Damping and Seismic Isolation', IUSS Press, Italy.
2. Soong, T.T. and Dargush, G.F. 1997. 'Passive Energy Dissipation Systems in Structural Engineering', John Wiley & Sons, New York, NY, 356 p.
3. Warburton, G.B. 1992, 'Reduction of Vibrations', The Third Mallet-Milne Lecture, John Wiley & Sons, New York, NY, 91 p.
4. Skinner, R.I., Robinson, W.H. and McVerry, G.H. 1993. 'An Introduction to Seismic Isolation', John Wiley & Sons, New York, NY. 354p.
5. Earthquake Engineering Research Institute 1990. 'THEME ISSUE Seismic Isolation: From Idea to Reality', Earthquake Spectra, Vol. 6, No. 2, May 1990, pp. 161-437.
6. Earthquake Engineering Research Institute 1993. 'THEME ISSUE Passive Energy Dissipating Systems', Earthquake Spectra, Vol. 9, No. 3, August 1993.
7. Vancouver Structural Engineers Group. 1997. 'Seismic Isolation and Energy Dissipation Technology', Technical Seminar, Vancouver, BC, Canada, June 21, 1997.
8. Applied Technology Council 1986. 'Seminar on Base Isolation and Passive Energy Dissipation', ATC-17, San Francisco, CA.
9. Applied Technology Council 1993. 'Proceedings of Seminar on Seismic Isolation, passive Energy Dissipation, and Active Control', ATC 17-1, Volumes 1 and 2, San Francisco, CA.
10. Filiatrault, A. 1998. 'Elements of Earthquake Engineering and Structural Dynamics', Polytechnic International Press, Montreal, Canada, 376 p.
11. 'Earthquake Protection of Buildings', 1991. Proceedings of the International Meeting on Earthquake Protection of Buildings, Ancona, Italy.
12. Den Hartog, J.P. 1956. "Mechanical Vibrations", Dover Publications, New York.
13. Kelly, J.M. 1997. "Earthquake-resistant Design with Rubber". Springer, New York, 243p.

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## COURSE OBJECTIVES:

The main objective of the course is to familiarize Structural Engineers with the various innovative systems that have demonstrated considerable potential through analytical studies, experimental testing and actual structural implementation. The discussion will focus on passive energy dissipation systems and base isolation systems. This course is intended for senior graduate students majoring in Structural Engineering.

## COURSE PROJECT

The objective of the project is to evaluate the effect and recommend an optimum innovative system for the seismic retrofit of a particular building structure. Students are divided into teams of three or four during the first lecture. Each team will be working on the same building structure but will have to consider different specified earthquake design ground motions or criteria. Each assignment will represent a phase of the project, and will be related to a particular innovative system discussed in the class. For each system, an optimum retrofit strategy will be sought. Each team will hand in only one project report at the last lecture. The project report must reflect the various phases of the project and must include the optimum solution for each system. A final recommendation among the various systems studied must be given at the end of the report.
After the last lecture, each team will make an oral presentation to the class on the main findings of their project. This session will be open to the public.

## TENTATIVE COURSE OUTLINE:

Course Introduction
Introduction to Supplemental Damping and Seismic Isolation
Energy Concepts in Earthquake Engineering
Basic Concepts of Passive Energy Dissipation – Metallic Dampers
Friction Dampers
Viscous and Viscoelastic Dampers
Self-Centering Dampers
Tuned Mass Dampers
Seismic Isolation Theory
Laminated Rubber and Lead-Rubber Bearings
Metallic, Lead Extrusion and Sliding Bearings
Introduction to Active Control of Structures

## GRADING POLICY:

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|---|---|
| Project Report | 40-50% |
| Project Oral Examination | 20% |
| Final Written Examination | 30-40% |

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## TENTATIVE EXAMINATION SCHEDULE:

| Exam | Material | Date and Time |
|---|---|---|
| Final | Comprehensive | Finals Week |

## FINAL EXAMINATION FORMAT:

All examinations are closed book, but one formula sheet of size A4 is allowed in the final written examination.

## COURSE WEBSITE:

http://sina.sharif.edu/~ahmadizadeh/courses/strcontrol/

## CORRESPONDENCE:

Correspondence via email or posted on the course website is considered received and observed by all students. Please update your email address in your university personal profile to ensure the receipt of the emails sent to you, and check the course website frequently.

## USE OF COMPUTER SOFTWARE:

During this course, the students are free to choose the software for analysis and design of the structure considered in their project. Students will also have access to a free version of the program RUAUMOKO for this purpose.