

CE391 - FUNDAMENTALS OF STRUCTURAL DYNAMICS - Mühendislik Fakültesi Dekanlığı - İnşaat Mühendisliği Bölüm Başkanlığı
General Info

Objectives of the Course

1. Comprehension of the fundamental concepts related to dynamic response and dynamic loading situations. 2. Ability to analyze free and forced vibrations of single-degree-of-freedom (SDOF) systems. 3. Understanding the effect of damping on dynamic response and the ability to include damping in dynamic analysis of SDOF systems. 4. Developing a basic understanding on dynamic response of multi-degree-of-freedom (MDOF) systems. 5. Ability to conduct dynamic analysis of MDOF systems by using the mode superposition technique.

Course Contents

Fundamental concepts related to dynamic analysis, dynamic response of SDOF systems, free, forced, undamped, and damped vibrations of SDOF systems, response spectrum, dynamic response of MDOF systems, mode superposition technique for dynamic analysis of linear structural systems.

Recommended or Required Reading

1. A. K. Chopra, Dynamics of Structures: Theory and Applications to Earthquake Engineering, 5th Edition, Prentice Hall, Englewood Cliffs, New Jersey, 2017. The S.I. edition of this book was published in 2015. (This textbook has been translated into Japanese, Korean, Chinese, Spanish, Greek, Turkish, and Persian.) ,2. Vedat Yerlici, Hilmi Luş, Yapı Dinamiğine Giriş, 2007, Mart Matbaacılık Sanatları, ISBN975-6193-68-6. ,3. Donaldson, Bruce K. 2006. Introduction to Structural Dynamics. Cambridge: Cambridge University Press.

Planned Learning Activities and Teaching Methods

Dynamic systems will be created with simple materials and their parameters will be partially measured and/or calculated.

Recommended Optional Programme Components

Accelerometers on mobile phones will be used in classroom activities. When the time comes, the necessary applications will be requested to be installed.

Instructor's Assistants

Mehmet Atay

Presentation Of Course

Oral presentation

Dersi Veren Öğretim Elemanları

Prof. Dr. Gürsoy Turan

Program Outcomes

1. Students will be able to understand the basic concepts related to the dynamic response, dynamic loading situations and their differences as compared to static ones.
2. Students will be able to analyze free and forced dynamic response of SDOF systems.
3. Students will be able to comprehend the effect of damping on dynamic response, and will be able to include damping within dynamic analysis.
4. Students will have a basic understanding on dynamic response of MDOF systems.
5. Students will be able to conduct dynamic analysis of linear structural systems by means of mode superposition technique.

Order	Preparation	Info	Laboratory	Teaching	Methods	Theoretical	Practise
1						Introduction- Fundamental concepts in structural dynamics	
2						Single-degree-of-freedom (SDOF) systems: Equation of motion, undamped free vibrations.	
3						SDOF systems: Damped free vibrations, introduction to forced vibrations.	
4						SDOF systems: Harmonic forcing, resonance, harmonic support excitation, phase angle.	
5						SDOF systems: Response under general loading, impulse, Duhamel's integral	
6						Midterm Exam 1	
7						SDOF systems and response spectrum	
8						Multi-degree-of-freedom (MDOF) systems: Equation of motion, undamped free vibrations, modal shapes and their properties	
9						MDOF systems, modal coordinates.	
10						MDOF systems: Damping in structures and damping matrix, damped free vibrations of MDOF systems.	
11						Midterm Exam 2	
12						Dynamic analysis of linear structural systems with mode superposition technique	
13						Dynamic analysis of linear structural systems with mode superposition technique	
14						Dynamic analysis of linear structural systems with mode superposition technique	

Workload

Activities	Number	PLEASE SELECT TWO DISTINCT LANGUAGES
Vize	2	2,00
Kısa Sınav	3	0,30
Final	1	3,00
Derse Katılım	42	0,75
Ödev	3	6,00
Uygulama / Pratik	7	2,00
Ders Öncesi Bireysel Çalışma	28	0,50
Ara Sınav Hazırlık	2	7,00
Final Sınavı Hazırlık	1	10,00
Ders Sonrası Bireysel Çalışma	28	1,00

Assesments

Activities	Weight (%)
Vize	40,00
Kısa Sınav	10,00
Ödev	10,00
Final	40,00

	P.O. 1	P.O. 2	P.O. 3	P.O. 4	P.O. 5	P.O. 6	P.O. 7	P.O. 8	P.O. 9	P.O. 10	P.O. 11
L.O. 1	5	5		3	3	3	3	3			
L.O. 2	5	5		3	3	3	3	3			
L.O. 3	5	5		3	3	3	3	3			
L.O. 4	5	5		3	3	3	3	3			
L.O. 5	5	5		3	3	3	3	3			

Table :

- P.O. 1 :** The ability to possess sufficient knowledge in mathematics, science, and civil engineering and effectively use this knowledge to solve complex engineering problems.
- P.O. 2 :** The ability to identify, formulate, and solve complex multi-component engineering problems by selecting and applying appropriate analysis and modeling methods.
- P.O. 3 :** The ability to design a complex system or process that meets needs under realistic constraints such as economic, environmental, health, safety, manufacturability, and sustainability.
- P.O. 4 :** The ability to select and use the necessary techniques, analysis, and modeling methods for solving complex problems encountered in civil engineering applications; the ability to effectively use modern engineering tools and information technologies to solve complex problems.
- P.O. 5 :** The ability to design and conduct experiments, collect data, analyze, and interpret data for the analysis and solution of complex civil engineering problems or research topics.
- P.O. 6 :** The ability to work in teams composed of civil engineers and/or multidisciplinary teams.
- P.O. 7 :** Effective verbal and written communication skills in English, including writing and understanding reports, preparing design and production reports, making effective presentations, and giving and receiving clear and understandable instructions.
- P.O. 8 :** The ability for lifelong learning, accessing information, keeping up with technological developments in the field, and self-renewal.
- P.O. 9 :** Awareness of professional and ethical responsibilities; knowledge of the standards used in civil engineering applications.
- P.O. 10 :** Knowledge of project management, risk management, and change management; understanding of entrepreneurship, innovation, and sustainability.
- P.O. 11 :** Knowledge of current issues and the impact of professional practices on the environment, health, and safety in a universal and societal context; awareness of the legal consequences of professional activities.
- L.O. 1 :** Students will be able to understand the basic concepts related to the dynamic response, dynamic loading situations and their differences as compared to static ones.
- L.O. 2 :** Students will be able to analyze free and forced dynamic response of SDOF systems.
- L.O. 3 :** Students will be able to comprehend the effect of damping on dynamic response, and will be able to include damping within dynamic analysis.
- L.O. 4 :** Students will have a basic understanding on dynamic response of MDOF systems.
- L.O. 5 :** Students will be able to conduct dynamic analysis of linear structural systems by means of mode superposition technique.