Karlsruher Institut für Technologie

Institut für Mechanik
Prof. Dr.-Ing. Karl Schweizerhof
Prof. Dr.-Ing. Thomas Seelig

Short Course
Lectures on Random Vibrations for Earthquake Engineering

Professor Jorge E. Crempien Laborie, Ph.D.

Vorlesung: Mittwoch, 15.45 – 17.15 Uhr, Seminarraum Institut für Mechanik (Geb. 10.30)
Dauer: 8 – 10 Termine
Beginn: 03.05.2011

Contents

1 Basic Concepts of Probability Theory: Set theory and Concept of probability, Axioms and theorems.

2 Theory of Random Variables: Definition and probability description, Probability description of several random variables. Expected values: Moments and Characteristic Functions. Functions of Random Variables. Distributions.

3 Theory of Random Processes: Definition and probability description, Expected values: moments. Operations on random processes. Some important Random Processes: Normal process, Poisson Process, Markov process. Application to seismic risk.

4 Modeling of strong ground acceleration processes: Stationary models, non stationary models. Gaussian models. Generation of seismicity compatible artificial earthquake records for seismic structural analysis.

5 Response of linear systems to random processes. Dynamical 1DOF linear systems, Probabilistic structure of the response, mean response, covariance and mean square response. Response to earthquakes. Approximated methods. Average response spectrum.

6 Response of MDOF systems to random process. Mean responses and Mean square responses. Structure-Equipment Interaction.

Objectives

Teach the students how to use the theory of probability in modelling seismic excitation and how to characterize the response of linear systems to earthquake from a probabilistic point of view.

Bibliography

1. Lin Y.K., (1967), **Probabilistic theory of structural dynamics**, McGraw-Hill.
2. Nigam N.C., (1983), **Introduction to random vibrations,** MIT Press.
3. Roberts, J.B., Spanos P.D. (1999), **Random Vibrations and Statistical Linearization,** John Wiley and Sons.
4. Clough R.W., Penzien J.P. (1972) **Dynamics of Structures,** McGraw-Hill