STABILITY OF STRUCURES

Instructor: Y. B. Yang (楊永斌)
Classroom 土 224, 14:20 – 17:20, Friday
Civil Engineering Department, NTU
January 25, 2013

A. Textbook

Z. Bazant and L. Cedolin, *Stability of Structures, Elastic, Inelastic, Fracture and Damage Theories,* World Scientific, 2010.

B. Duration

This semester begins on February 18, 2013 and ends on June 21, 2013. There is a total of 18 weeks, including the final week starting from June 17, 2013 for final exam.

C. Objectives

Stabilty is the main reason for structural failures. It is only when you are equipped with the ability to understand and analyze the problem of stability for various types of structures, so that you can come up with the design of safe and healthy structures.

This course intends to cover the problems of structural stability from special to general, from simple to complex, treating each subject as concisely as we can and at the lowest possible level of mathematical operations we know, but not so low as to sacrifice efficiency of presentation. Solving many of the exercise problems is essential for the students to master the subject.

D. Principles

1. It is the *sole responsibility* of the students to conduct the exercises assigned by the instructor and to really understand what are implied by these exercises. Whether you earn or lose depends fully on yourself (盈虧自負).
2. *Never drop away from the class without any excuse*. Some penalties will be enforced for the students missing from the class with no reasons. If you don't like this course, you should not select it from the beginning.
3. Whether a course is successful or not depends on *how many questions are raised by the students in the classroom* and *how the students interact with the instructor*. The students are encouraged not just to sit in the classroom, listening and writing down what the instructor has said. They are an active part of classroom activity.
4. I wish the course to be conducted in a *forum, interactive style*, rather than in the traditional, one-way teaching style. I would like to invite you to raise your questions, comments and discussion on any problem at any moment you like.
5. From time to time, some stories behind the great scientists, mathematicians, engineers, and engineering projects will be given, along with the ethical codes and examples of major structural failures highlighted.

E. Examinations and exercises

1. Exercises and paper reading (30 %)

2. Midterm exam (35 %)

   The midterm exam is tentatively scheduled for *April 19, 2014* (Friday).

2. Final exam (35 %)

   The final exam will be held on *June 21, 2013*, as scheduled by the university.

F. For help

Prof. Y. B. Yang, Office: New Civil Engineering Building (土木新館) Room 507

I can be reached most of the time through the e-mail: ybyang@ntu.edu.tw.

G. Contents to be covered by weekly lectures

The materials to be covered in this course are those of the first few chapters of the book by Bazant and Cedolin. Since this is the first time for the course to be offered, efforts will be made to cover as many subjects of the book as possible. In some cases, some of the sections presented in the book may be deleted due to tedious mathematical operations involved. The final, real coverage of the course depends on the level of digestion revealed by the students.

The following is a list of the possible subjects to be covered in the semester.

Ch. 1 Bucking of elastic columns by equilibrium approach

- 1.1 Theory of bending
- 1.2 Euler load, adjacent equilibrium, and bifurcation
- 1.3 Differential equations of beam-columns
- 1.4 Critical loads of perfect columns with various end restraints
- 1.5 Imperfect columns and the Southwell plot
- 1.6 Code specifications for beam-columns
- 1.7 Effect of shear and sandwich beams
- 1.8 Pressurized pipes and prestressed columns
- 1.9 Large deflections
- 1.10 Spatial buckling of beams under torque and axial force

Ch. 2 Buckling of Elastic Frames by Equilibrium Analysis

- 2.1 Stiffness and flexibility matrices of beam-columns
- 2.2 Critical loads of frames and continuous beams
- 2.3 Buckling as a matrix eigenvalue problem and use of finite elements
- 2.4 Large regular frames