

DRAFT
Winter 2005

Portland State University
Department of Civil and Environmental Engineering

CE 410/510 Fluid Transients in Pipelines and Systems with Turbomachines (3 Credit hrs.)

This course is a study of unsteady confined flow in pipeline transmission and distribution systems with valves and turbomachinery. Methods will be presented for the analysis of a broad range of fluid transient conditions and the design of facilities to cope with problems that may develop. Emphasis will be placed on numerical methods in conjunction with a fundamental understanding of the theory of confined transient flow. These basic concepts will be emphasized through out the material covered. The method of characteristics will be utilized in most cases for the analysis and solution of the differential equations that characterize transient flow. Other methods will be used selectively show the relationships of all the numerical procedures. Comparison with experimental results; laboratory data; and prototype tests will be covered. Students will be given special projects to analyze and present to the class.

Textbook: Fluid Transients in Systems, Wylie, E. Benjamin and Streeter, Victor L. Prentice Hall

Instructor: B. C. Cook, Ph.D, P.E.

Goals: The structure of the course is designed to impart to the students that are already in professional practice, as well as upper division and graduate students the knowledge to identify, analyze and design fluid systems that are safe and operable. The student should also gain an understanding of and an appreciation of the many software packages available within the market and the profession and be able to objectively analyze and evaluate the output from these packages.

Prerequisites by Topic:

1. Basic Fluids
2. Hydraulics
3. Differential Equations
4. Computer skills

Topics:

1. Review of Basics, Available Literature, Software Packages
2. Concepts of Transient Flow and Physical Principles
3. Method of Characteristics, Wave Propagation, Time Constraints
4. Single Pipe Example, Results Interpretations, Frictional Effects, Attenuation and Line Pack
5. Wave Transmission and Reflection
6. Valve Characteristics and Valve Modeling, Pipe Junctions and Networks
7. Pump Characteristics, Pump Modeling, Pump Stations
8. Vapor Cavities, Free Gas, Column Separation
9. Transient Control, Surge Tank analysis and Design
10. Project Presentations
11. Project Presentations, Examination