BEAM THEORY – INTRODUCTION

STRUCTURAL MECHANICS

The ERAMCA Project

Environmental Risk Assessment and Mitigation on Cultural Heritage assets in Central Asia

v2022317

Table of Contents

LECTURER/STUDENTS OBJECTIVES

Lecturer/students objectives

- Present the main aspects of the behaviour of beams subjected to different actions.
- Evaluate strength, deformability and stability of a beam.

Introduction

Aim of the lesson

The beam is the most common structural element used in engineering and architecture. The study of its behavior is the main object of the course.

A beam is a structural element with one dimensions (length) larger than the others This property make it possible:

- reduce the complexity of a three-dimensional problem
- describe the behavior of the beam is based on the knowledge of the longitudinal axis position (and from external loads and constraints)

SUMMARY

Summary (1/2)

1.9 Stress definition

1.9.1 Mohr's circles (plane stress)

1.10 Physical meaning of the material properties

1.11 Elastic stresses:

1.11.1 normal stress

1.11.2 tangential stress

1.11.3 tangential stress

1.12 Failure due to exceeding the strength limit in the cross sections (material failure theories):

1.12.1 combined stress

EXAMPLES

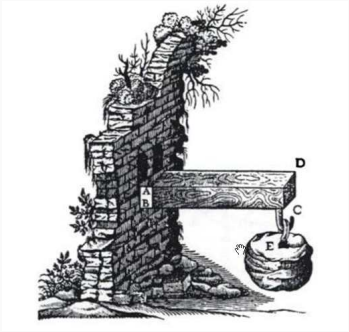
Example: Swimming pool in Rome, wooden beams

Example: Politecnico di Torino, steel

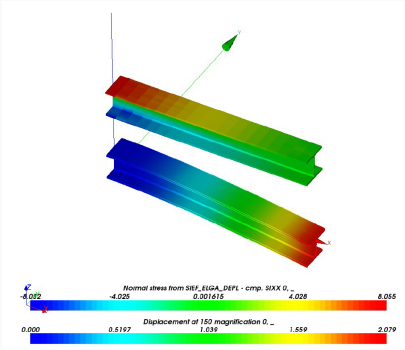
Example: prestressed concrete beams

Example: Beijing National Stadium

Past and future...



G. Galilei, Discorsi e dimostrazioni matematiche intorno a due nuove scienze (1638)



Contour plot for stresses (top) and displacement (bottom) obtained with the Finite element method