1.050 Engineering Mechanics

Lecture 3: Dimension analysis and application to engineering structures
I. Dimensional analysis
   1. On monsters, mice and mushrooms
   2. Similarity relations: Important engineering tools

II. Stresses and strength
   2. Stresses and equilibrium
   3. Strength models (how to design structures, foundations.. against mechanical failure)

III. Deformation and strain
   4. How strain gages work?
   5. How to measure deformation in a 3D structure/material?

IV. Elasticity
   5. Elasticity model – link stresses and deformation
   6. Variational methods in elasticity

V. How things fail – and how to avoid it
   7. Elastic instabilities
   8. Plasticity (permanent deformation)
   9. Fracture mechanics
I. Dimensional analysis
   Lecture 1: Introduction & Galileo's problem
   Lecture 2: Dimensional Analysis and Atomic Explosion
   Lecture 3: Dimension analysis and application to engineering structures

II. Stresses and strength

III. Deformation and strain

IV. Elasticity

V. How things fail – and how to avoid it
D-Analysis of Tall Buildings

Graphic of tall buildings removed due to copyright restrictions.

Hurricane Katrina

Wind speeds 200 km/h

http://www.nasa.gov/images/content/126301main_Katrina_082805_516.jpg
http://www.asiatraveltips.com/newspics/074/BurjDubai.jpg

Photograph of skyscraper removed due to copyright restrictions.
Lab Results: Drag Coefficient on smooth objects

\[ C_D = 2\Pi_0 = \frac{2F_D}{\rho a U^2 D^2} \]

Reynolds Number \( \text{Re} = \Pi_1^{-1} = \frac{UD}{v} \)

\[ \Pi_0 = \frac{F_D}{\rho a U^2 D^2} = F \left( \Pi_1 = \frac{v}{UD} \right) \]

Figure by MIT OpenCourseWare.