

A short course on

# Stress

This video:

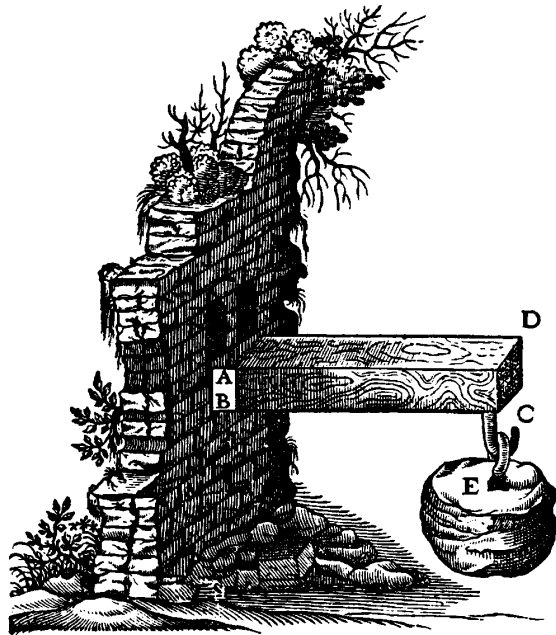
## **The Concept of Stress**

Terje's Toolbox is freely available at [terje.civil.ubc.ca](http://terje.civil.ubc.ca)

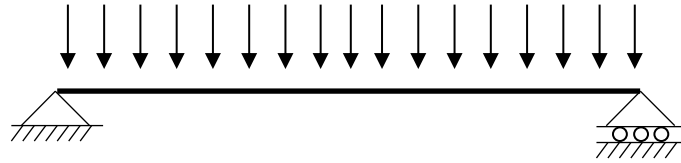
It is created and maintained by Professor Terje Haukaas, Ph.D., P.Eng.,  
Department of Civil Engineering, The University of British Columbia (UBC), Vancouver, Canada

# The History of Stress

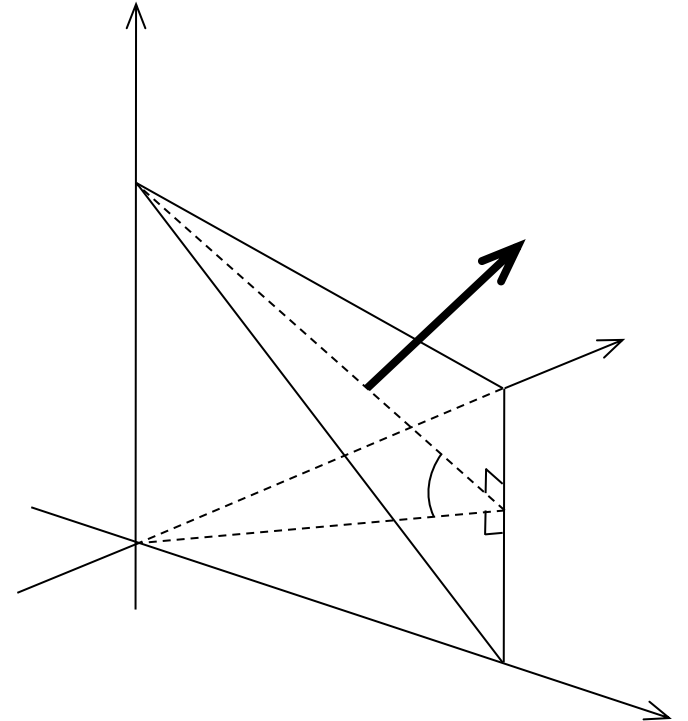
Galileo (1638)



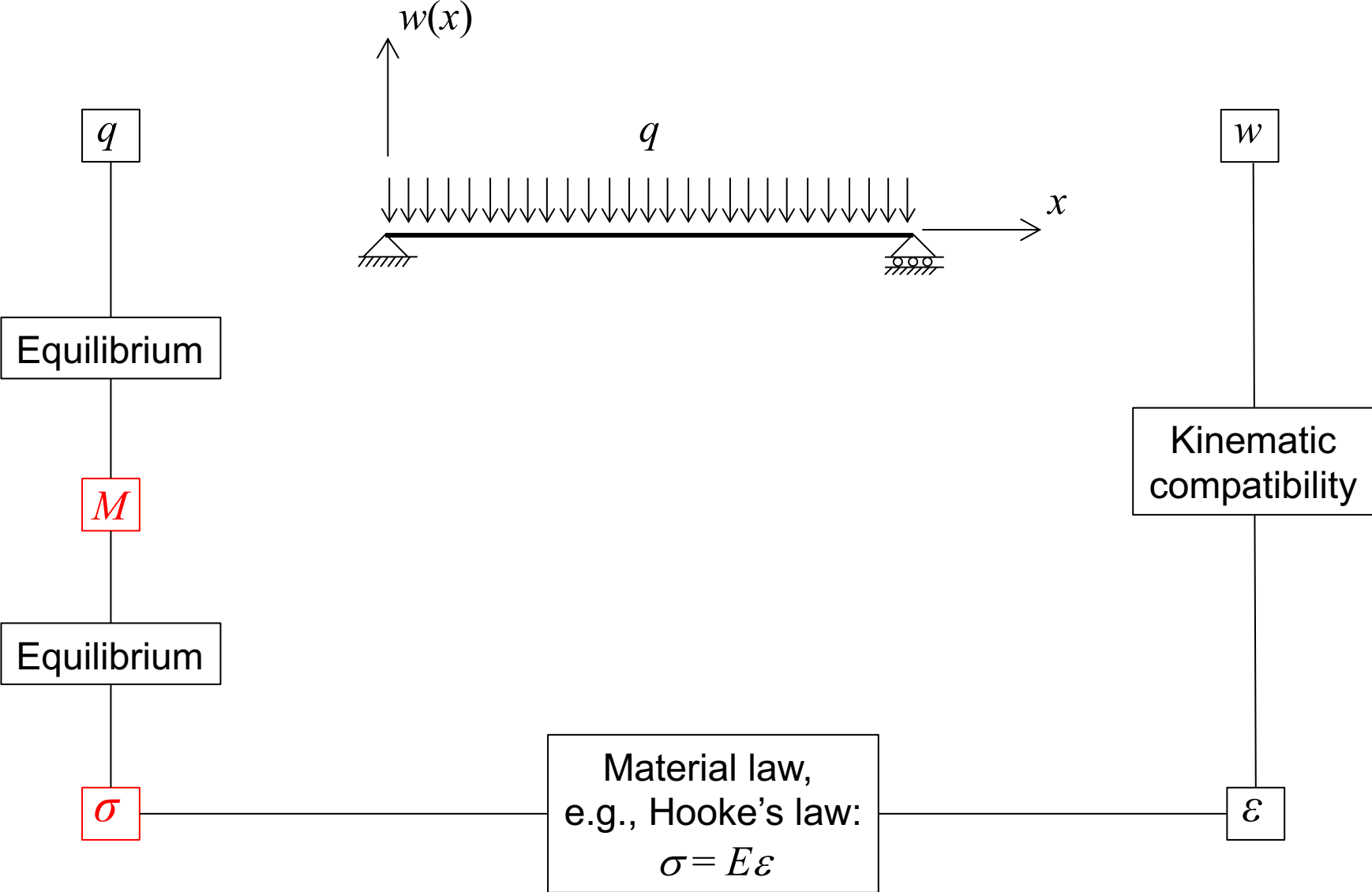
Euler-Bernoulli (1750)



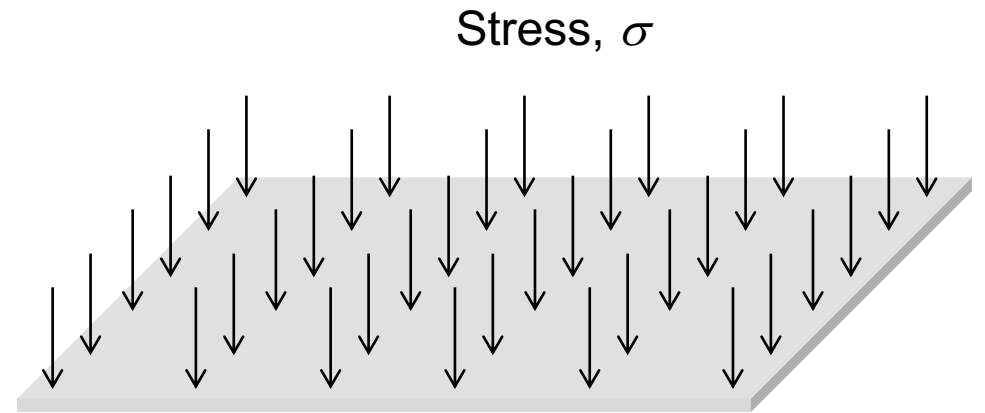
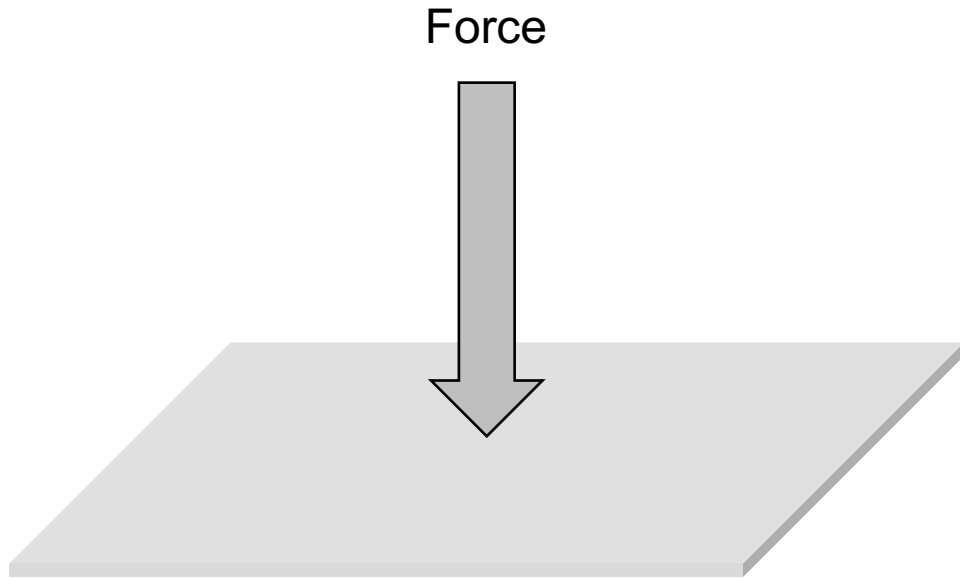
Cauchy (1822)



# The Role of Stress



# Force per Unit Area



$\text{N/m}^2 = \text{Pascal} = \text{Pa}$

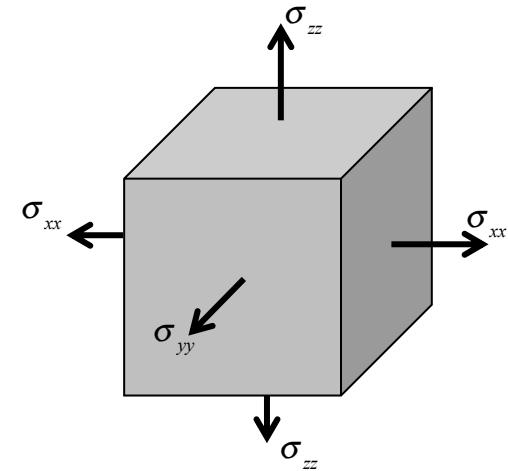
$\text{N/mm}^2 = \text{MPa}$

# Do Stresses Exist?

Real world

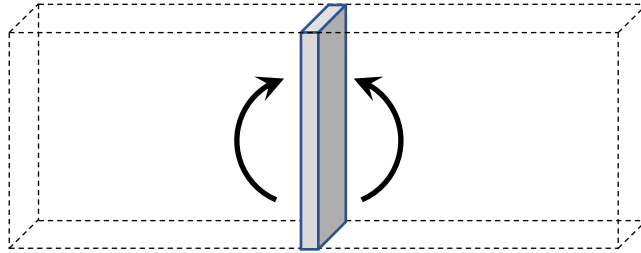


Continuum model



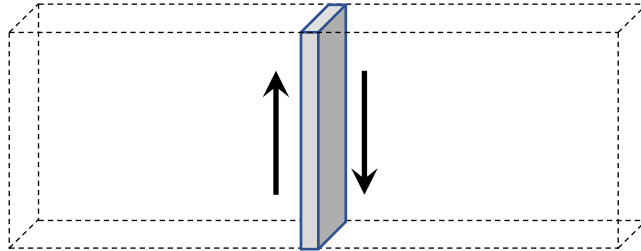
# Stress Resultants

Bending moment,  $M$



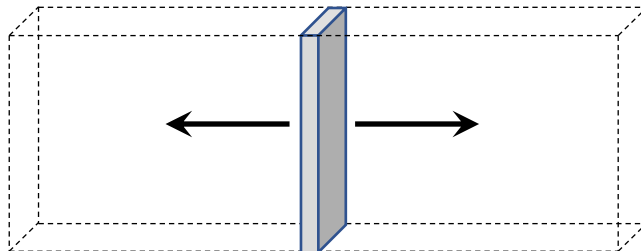
Bending moment diagram, BMD

Shear force,  $V$



Shear force diagram, SFD

Axial force,  $N$



Axial force diagram, AFD

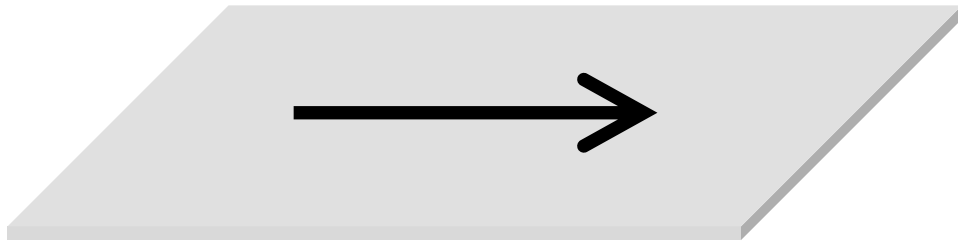
# Typical Stress Values

$$\sigma = E \cdot \varepsilon$$

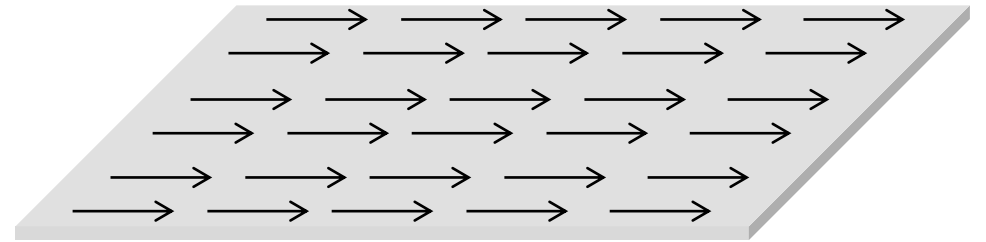
	Modulus of Elasticity [MPa]	Strength [MPa]
Steel	200,000	350
Concrete	25,000	30
Wood	10,000	15

# Shear Stress

Force

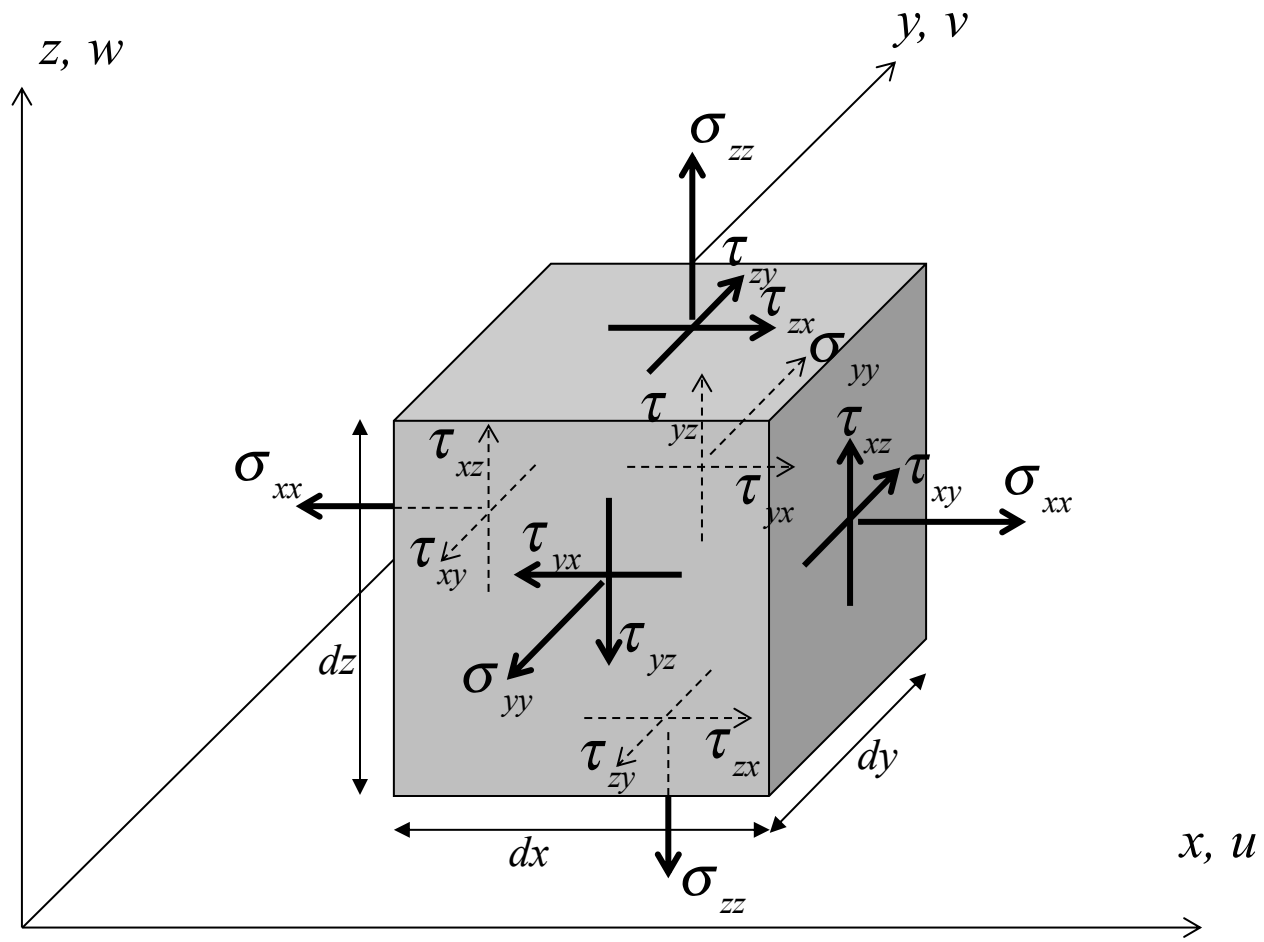
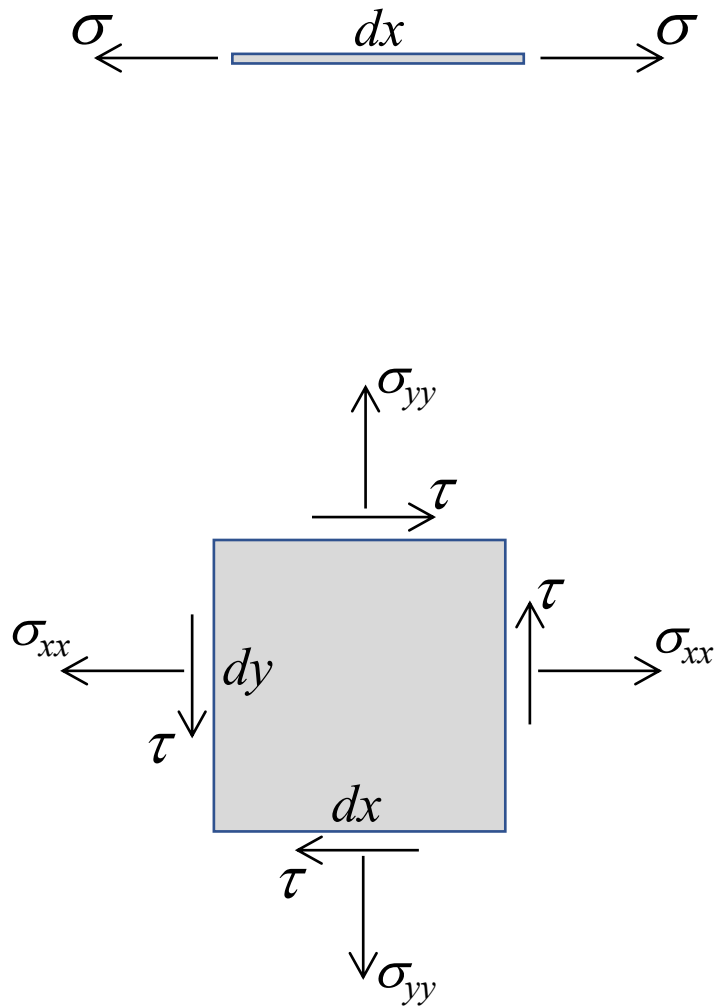


Stress,  $\tau$





# Coordinate Stress



More lectures:

Terje's Toolbox:

[terje.civil.ubc.ca](http://terje.civil.ubc.ca)