

# Lecture Module - Spring Systems

ME3050 - Dynamics Modeling and Controls

Mechanical Engineering

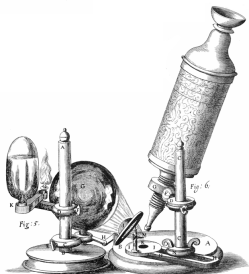
Tennessee Technological University

## Topic 1 - The Ideal Spring

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- Robert Hooke
- Hooke's law of Springs
- The Spring Model
- Structure Stiffness

# Robert Hooke



*Rob: Hooke*

- Mechanics
- Gravitation
- Horology
- Microscopy
- Palaeontology
- Astronomy
- Memory

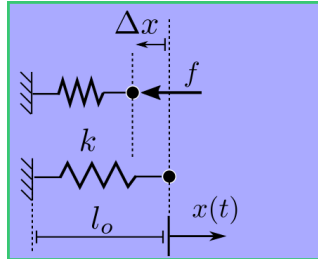
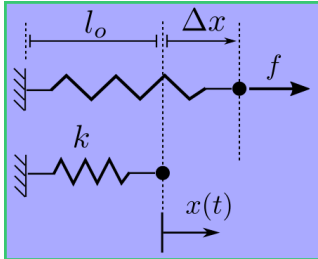
Images: Wikipedia

# Robert Hooke

Robert Hooke FRS (...1635 ...1703) was an English natural philosopher, architect and polymath. As a young adult, he was a financially impoverished scientific inquirer, but came into wealth and good reputation following his actions as Surveyor to the City of London after the great fire of 1666 (in which he appears to have performed more than half of all the surveys after the fire). At that time, he was also the curator of experiments of the Royal Society, a member of its council, and the Gresham Professor of Geometry. He was also an important architect of his time—though few of his buildings now survive and some of those are generally misattributed—and was instrumental in devising a set of planning controls for London, the influence of which remains today. Allan Chapman has characterised him as "England's Leonardo".[1]

Text: Wikipedia

# Hooke's law of Springs



The simple and effective model of spring behavior is called the **linear force-deflection model**.

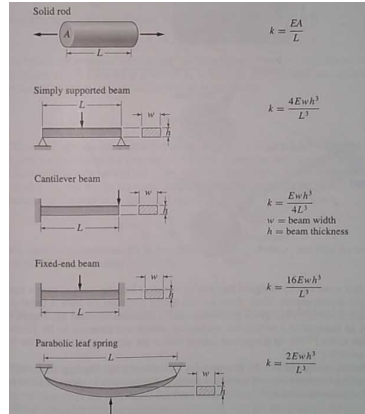
# Hooke's law of Springs



Table 2 Shear Modulus of Elasticity(G)

Material		G Value N/mm <sup>2</sup> (kgf/mm <sup>2</sup> )	Symbol
Spring Steel		$78 \times 10^3 (8 \times 10^3)$	SUP6,7,9,9A,10,11A,12,13
Hard Steel Wire		$78 \times 10^3 (8 \times 10^3)$	SW-B,SW-C
Piano Wire		$78 \times 10^3 (8 \times 10^3)$	SWP
Oil Tempered Steel Wire		$78 \times 10^3 (8 \times 10^3)$	SWO,SWO-V,SWOC-V,SWOSC-V,SWOSM,SWOSC-B
Stainless Steel Wire	SUS 302	$69 \times 10^3 (7 \times 10^3)$	SUS 302
	SUS 304		SUS 304
	SUS 304N1		SUS 304N1
	SUS 316		SUS 316
	SUS 631 J1	$74 \times 10^3 (7.5 \times 10^3)$	SUS 631 J1

Data: MISUMI



Images: Wikipedia, System Dynamics

# The Spring Model

The ideal \_\_\_\_\_ is only  
an approximation of the true behavior. However,  
\_\_\_\_\_ materials do  
behave this way in the  
\_\_\_\_\_

# Structure Stiffness

All physical structures deform under load, and as we know, every force as reaction force. Therefore

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