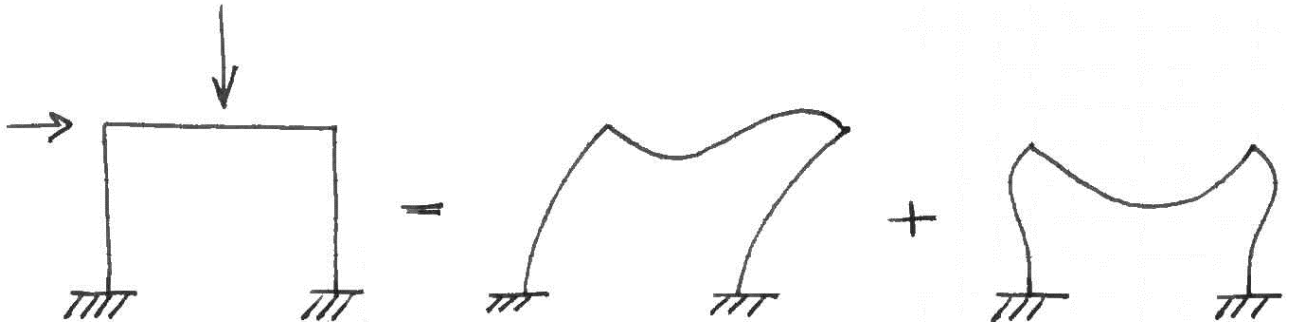
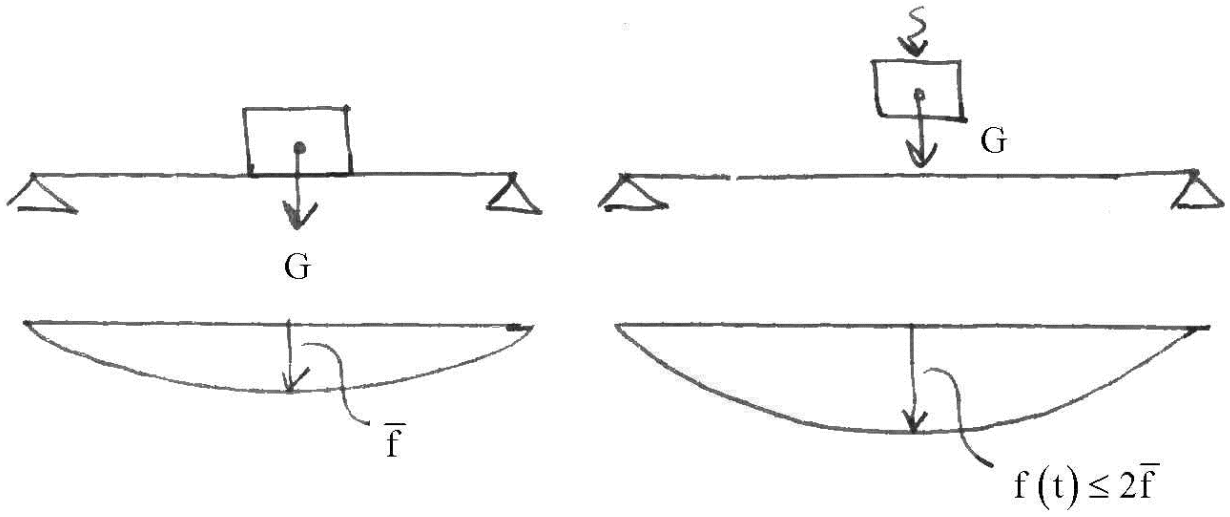
INTRODUCTION TO STRUCTURAL DYNAMICS

Structural mechanics frequently deals with static problems, i.e. problems which are independent of time. In these cases it is usual to consider an equilibrium configuration reached by increasing slowly forces and displacements. In other words, it considers that the evolution from the unloaded and undeformed configuration to the loaded and deformed configuration occurs through a series of equilibrium configurations.

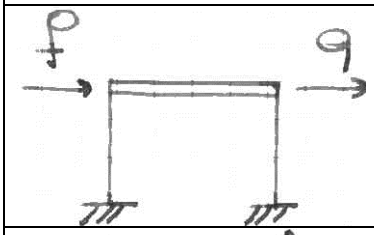
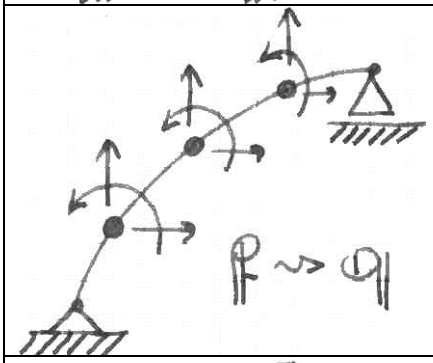
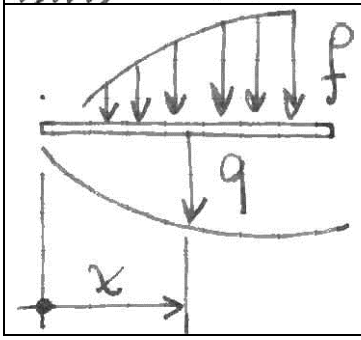


In reality, everey physical phenomenon concerning structural mechanics depends on time.



A mechanical problem may be dealt with as static when the time dependence is very slow, as in the case of snow accumulation, or when the time variation is limited to a small time interval, as in the case of the application of permanent loads.

A mechanical problem should be dealt with as dynamic when rapid time variations occur, as in the case of wind and seismic actions.

Presentation → ← Modelling			←Presentation Modelling→
Scheme	Static analysis	Dynamic analysis	
	$kq = f$ algebraic equation	$M\ddot{q}(t) + kq(t) = f(t)$ differential equation	
	$\mathbf{Kq = f}$ set of algebraic equations	$\mathbf{M\ddot{q}}(t) + \mathbf{Kq}(t) = \mathbf{f}(t)$ set of differential equations	
	$EJ\frac{d^4q(z)}{dz^4} = f(z)$ differential equation	$\mu\frac{\partial^2 q(z,t)}{\partial t^2} + EJ\frac{\partial^4 q(z,t)}{\partial z^4} = f(z,t)$ differential eq. at the partial derivatives	

The preliminary study of the S.D.O.F. system is motivated by several reasons:

1) It allows to write simple equations and explain simple physical concepts
2) Many real structures can be modelled (at least as a first approximation) by S.D.O.F. systems
3) Complex M.D.O.F. and continuous systems may be analysed through equations and concepts developed with reference to S.D.O.F. systems