

Structural Mechanics

Review on Chapter 11

1. To number the joints and elements; establish coordinate systems (编号及建立坐标)
2. To determine the element stiffness matrix $[\bar{k}]^e$ in local coordinate system (求出局部坐标系下的单元刚度矩阵 $[\bar{k}]^e$)
3. To determine the element stiffness matrix $[k]^e$ in global coordinate system (求出整体坐标系下的单元刚度矩阵 $[k]^e$)
4. To assemble the global stiffness matrix $[K]$ according to element orientation vector (按单元定位向量形成整体刚度矩阵 $[K]$)
5. To determine the equivalent nodal loads (求出结构的等效荷载列阵)
6. To find the nodal displacements $\{\Delta\}$ by solving the equation $[K]\{\Delta\}=\{F\}$ (解方程 $[K]\{\Delta\}=\{F\}$, 求出结点位移 $\{\Delta\}$)
7. To determine the member-end forces according the equation $\{\bar{F}\}^e = [\bar{k}]^e \{\bar{\Delta}\}^e + \{\bar{F}_P\}^e$ (按公式: $\{\bar{F}\}^e = [\bar{k}]^e \{\bar{\Delta}\}^e + \{\bar{F}_P\}^e$ 求出各杆杆端内力)

Chapter 12 Structural Dynamics (结构动力学)

12.1 Dynamic characteristics (动力特性) and Dynamic DOF (动力自由度) of a structure

Structural dynamics: to analyze the dynamic response (动力反应) of a structure under dynamic loading (动力荷载).

What loads can cause dynamics?

Earthquake

Wind

Explosion

Moving vehicles



Humen Bridge Vortex-Induced Vibration (涡激振动)



12.1 Dynamic characteristics (动力特性) and Dynamic DOF (动力自由度) of a structure

Static load

Structural system

Response to static loads (静力响应)

Displacement
Internal force
Stress

Magnitude
Direction
Position

Restraints
Structural properties

Fixed numbers (固定数值)

Dynamic load

Structural system

Response to dynamic loads (动力响应)

Dynamic displacement
Acceleration
Velocity
Dynamic stress
Dynamic factor
Vary with time

Magnitude
Direction
Position
Vary with time

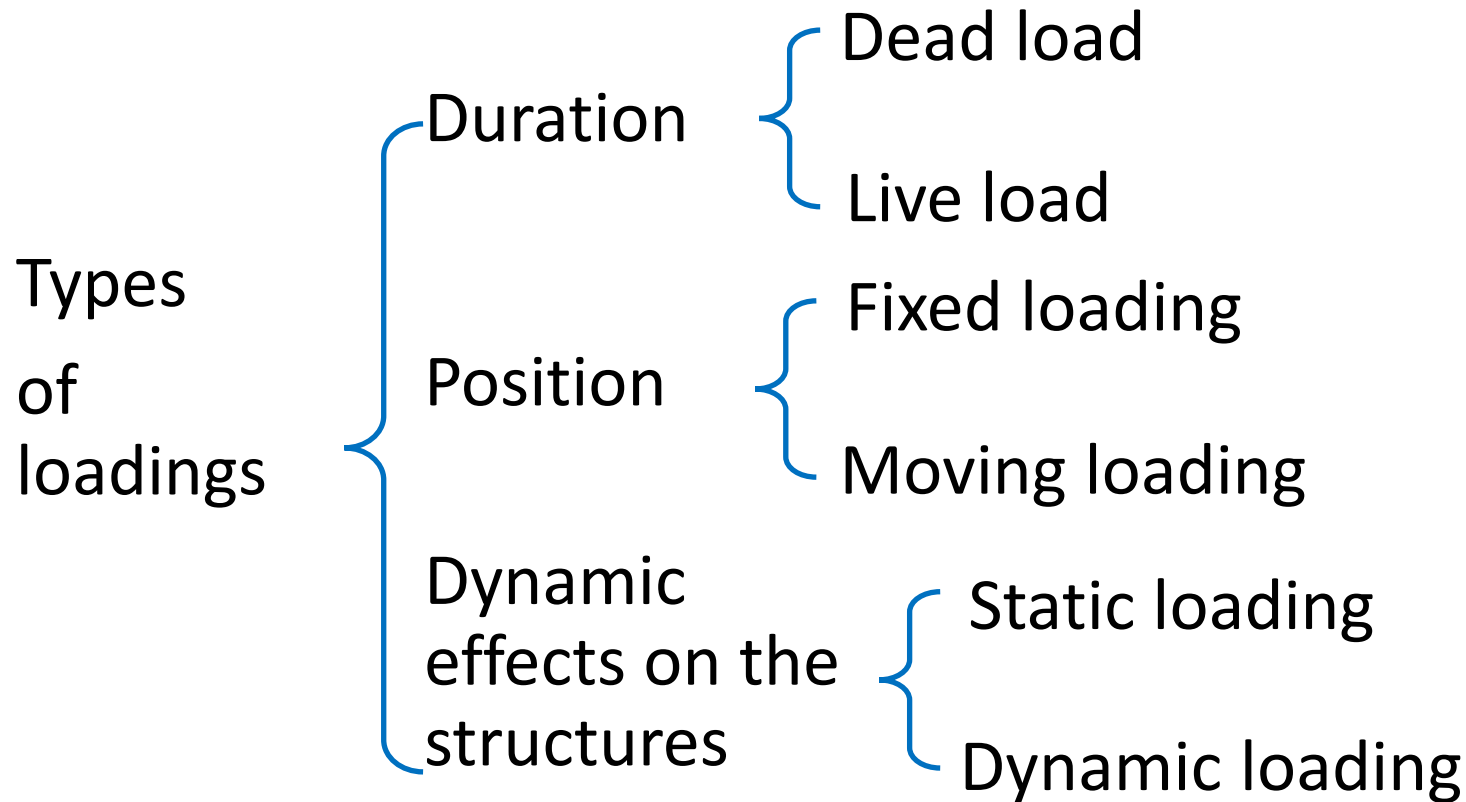
Mass, stiffness,
restraint,
frequency, mode

Time function (变化时间函数)

Definition and types of dynamic loads

Loading: active forces (主动力) acting on the structures

Three elements of loadings: magnitude, direction and position



Static loading: Any load of which its magnitude, direction and/or position **barely varies with time**.

Dynamic loading: any load of which its magnitude, direction and /or position **varies with time**.

Criteria to determine dynamic loadings (判断动力荷载的准则):

1. Whether **a remarkable acceleration** (加速度) is exerted on the structure
2. Whether the **inertial forces** (惯性力) caused by the acceleration **can be neglected** in comparison with the loadings。

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