

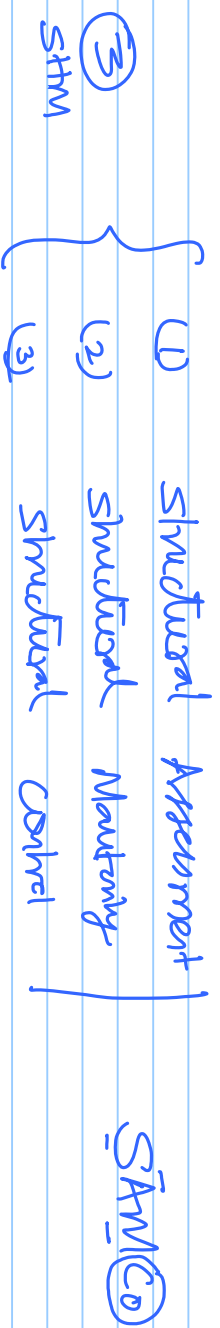
Structural Health Monitoring (SHM)

Lecture 01 - Module 1

- Introduction to SHM

SHM - general scope?

It includes the following



(1) Structural Assessment

deals with the assessment of
assessment is for
actual condition and
load capacity
of the structural systems

(2) Structural Monitoring

maintenance {
- deals with supervision of structures on a
continuous basis, using sensors (electronic gauges)
- in order to maintain the functional utility of
the structure

(3) Structural Control {
control mechanism
deals with controlling the dynamic response
behaviour of structures, under environmental loads

Priority

①

Assessment

(2) Maintenance

(3) Control

I

Existing condition of the structure

- geometric fibres
- load capacity

II

maintenance

- utility value
(or)
functional value

III

reduce (or) mitigate excessive response of the system

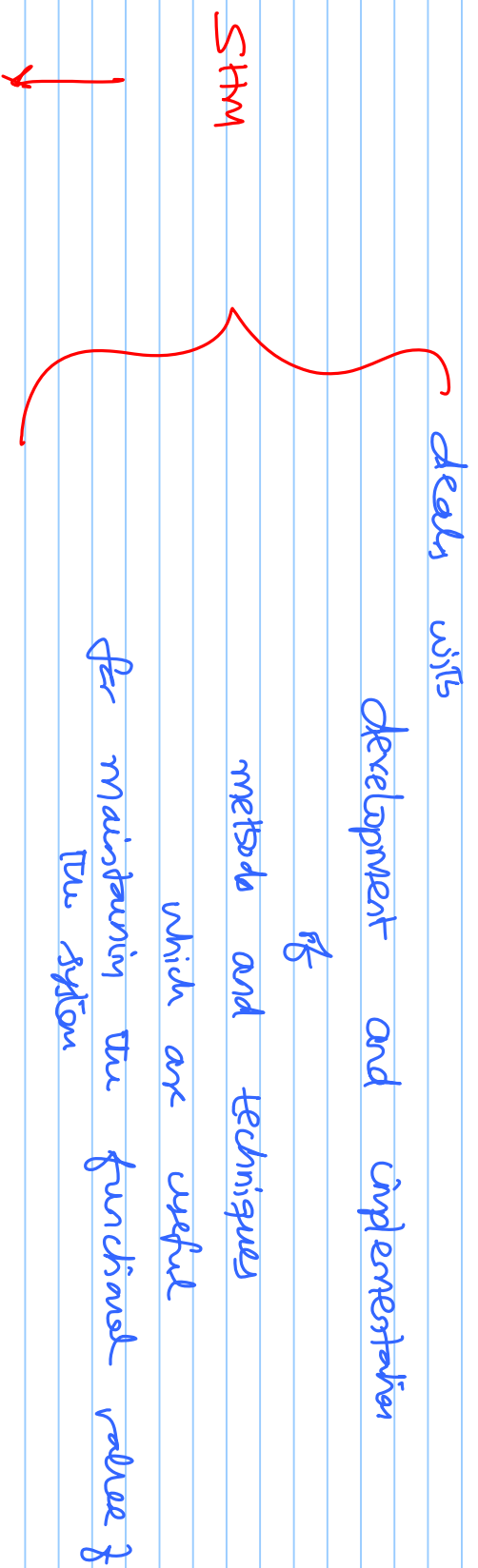
Priority depends on

✓ (1) Economic considerations

✓ (2) Type of structure Characteristic importance; for example

- Naval structure
- Aviation etc
- coastal etc

STHM - critical summary



- X control algorithm
- X load capacity
- but ensuring utility value of the structure
- even under the existing environmental condition.

Why maintenance of structures are important ?

i) To elevate the standard/quality of the structured system
in terms of its appearance

NO

ii) Industrial structures, bridges, Nuclear power plants, offshore structures
Naval systems etc

- Vital for the economic growth of the country
- towards ensuring safety and security for the public life
- Govern the commercial value of growth of the nation, is part matter

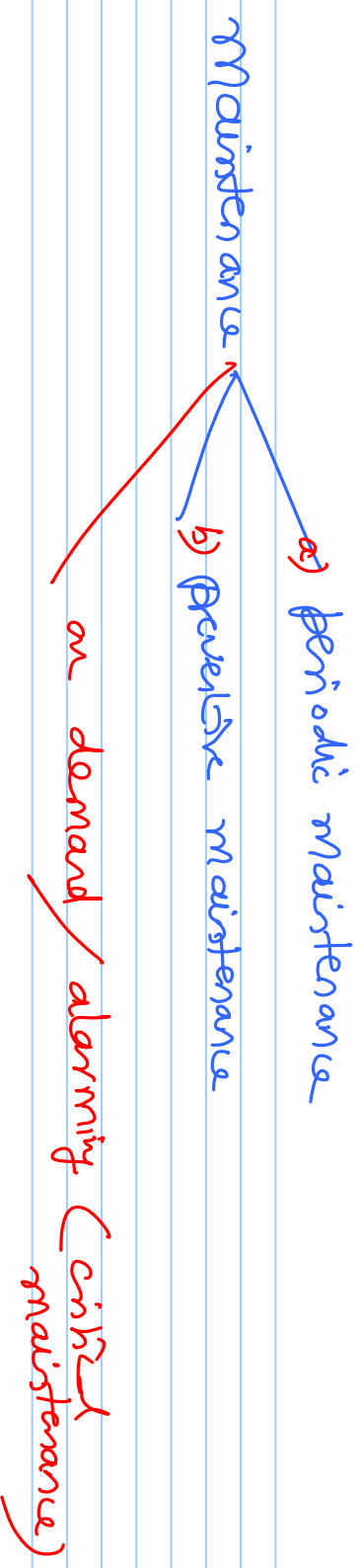
✓
- Society depends on these structures

- To exist and continue confidence, confidence is important
- Economic
 - Environment
 - Life-quality upshot
 - safety
 - Employment prospects

- Most of such structures

CRITICAL AGE

- result is
 - also reach
 - rights degradation
 - Quality & appearance
 - loss capacity
- overall dependency reduction



offshore structures

(1) oil & gas exploration & production

Ex: Tension leg platform, xxx location

outcome / commercial benefit

- Revenue
- Employment
- RIG - for further exploration / production

- 24x7
- oil & gas production

- Needs to be shut-down
- Downtime - loss of revenue

- Revenue loss is not preferred
- critical age ✓

- Strengths degradation

(material comparison)

- cannot (will not be able to) discriminate the lateral body successfully

- failure / can cause disaster

$$\text{loss of structural system} = \text{"accident" revenue loss}$$

- novel, unique, high CAPEx

- Preventive maintenance?

- To do a periodic maintenance

Sthm

- ✓ - areas the present condition
- ✓ - monitor the condition continuously
- ✓ - plan/repair procedure

- even before the structure actually needs it

- periodic maintenance

strategic structures can demand preventive maintenance

-

Main outcome / most important deliverable of

sth as applied to

structures of strategic importance

(Bridges, other structures, nuclear
reactors, reservoirs (dams), Railway
lines etc)

To avoid a pre-mature failure or a break-down
of the facility

- plan the maintenance procedures in advance
 - do maintenance whilst facility / structure is in use.

Example

Naval Dockyard

Dockyard - open channel ✓

- to house large vessels (ships)

for their periodic maintenance

- partial / complete weld upgrade
 - painting
 - treatment for bio fouling
 - upgrade / fault correction
- electro-chem systems etc

- Vessels - need to be inspected

(1) periodic maintenance
✓ ~~it~~ Emergency fault correction

Need Dockyard

- very few in Number

- Dockyard - maintenance - periodic } Dockyard cannot be
shut-down } operation } used

- this can be avoided - Dockyard - preventive maintenance

STM

- Inspection demands a complete analysis of the structural condition

~~Monitoring~~

- Monitoring the structure (sensors) time history response, the st is plotted

- (accelerogram)

- output graph of seismic graph

~~Assess~~

- Assessment of the condition of the structure - good, better, or very bad

Human body analogy

- Inspection - takes him to a medical doctor

diagnosis { monitoring health $\left\{ \begin{array}{l} BP \\ ECG \\ MRI \end{array} \right\}$

- plots are available - indicates the health (respiratory) condition of the human

- Present health condition of the human

- bad - patient
- good - human.

Engineer (Doctor) - Academic
Qualifications
Situation (pid)

- recommended control algorithms to reduce error completely minimize undesired responses of the structure

Ensure an overall
eg the system (human)

(Doctor) - medical
profession
human body and/or

- recommended a surgery
 - completely minimize the problem
- pace-maker
 - monitor & also warn the medical repairs system about its critical functions

Situation

Safety and satisfactory functions

Summary

- Structural health monitoring
 - objectives - briefly
 - steps in stm
 - stm - human body and
 - periodic maintenance - structures ↑ importance
 - Strengths - added values - discussion form
- APPL - IIM