SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)
Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai
Accredited by NAAC-UGC with 'A++' Grade (Cycle III) &
Accredited by NBA (B.E - CSE, EEE, ECE, Mech & B.Tech.IT)
COIMBATORE-641 035, TAMIL NADU

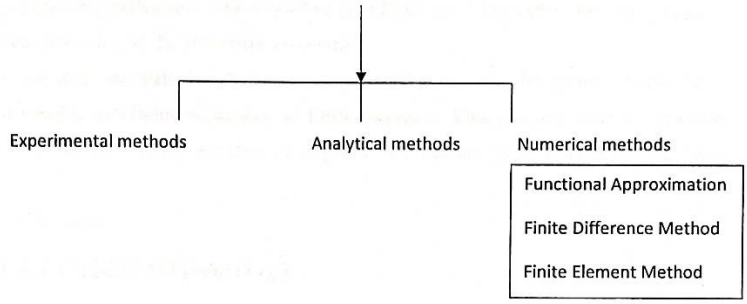
DEPARTMENT OF AEROSPACE ENGINEERING

Faculty Name	:	**Dr.M.Subramanian, Prof & Head/ Aerospace**	Academic Year	:	**2024-2025 (Odd)**
Year & Branch	:	**III Aerospace**	Semester	:	**V**
Course	:	**19ASB302 – Finite Element Method for Aerospace**			

Unit: 1

Finite element analysis

Methods of Engineering Analysis



Functional Approximation

- Classical methods- Rayleigh-Ritz method (complex structural problems)
- Galerkin methods -weighted residual methods (non structural problems)

Finite differential method

- Heat transfer /fluid mechanics/structural mechanics problem
- Differential equation/simultaneous equations generated-solving lead to approximate solution to the problem

Finite element method /Finite Element Analysis

-numerical method for solving problems of engineering and mathematical physics

-a body or structure ⟶ subdivided into smaller elements of finite elements called finite elements,

-nodes/ elements solved as whole to get solution

- Finite element method, instead of solving the problem for entire body in one operation, we formulate the equation for each finite element and combine them to obtain the solution of the whole body.
- Complicated geometrics, loading/material properties-to solve physical problems/which canot be solved by analytical method

This method is extensively used in the field of structural mechanics, fluid mechanics, heat transfer, mass transfer, electric and magnetic field problem

SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)
Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai
Accredited by NAAC-UGC with 'A++' Grade (Cycle III) &
Accredited by NBA (B.E - CSE, EEE, ECE, Mech & B.Tech.IT)
COIMBATORE-641 035, TAMIL NADU

DEPARTMENT OF AEROSPACE ENGINEERING

Faculty Name	:	**Dr.M.Subramanian, Prof & Head/ Aerospace**	Academic Year	:	**2024-2025 (Odd)**
Year & Branch	:	**III Aerospace**	Semester	:	**V**
Course	:	**19ASB302 – Finite Element Method for Aerospace**			

Unit: 1

Discretization

The process of modeling a structure using suitable number, shape and size of the elements is called discretization. The modeling should be good enough to get the results as close to actual behavior of the structure as possible.

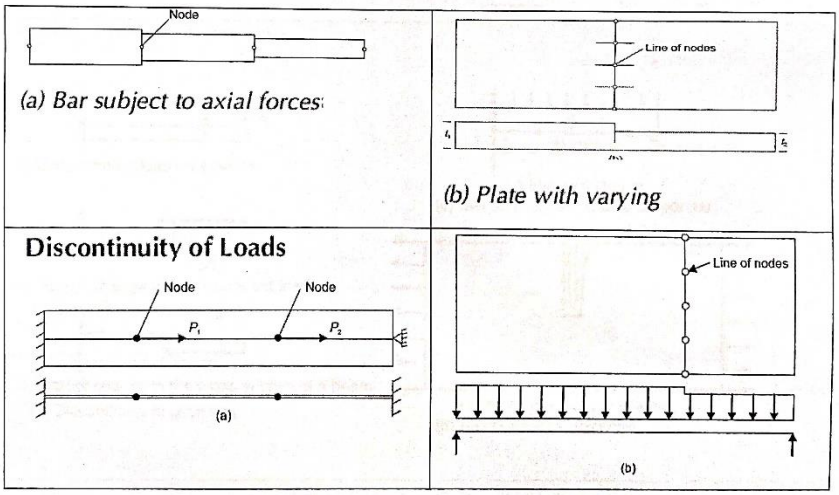
The finite element analysis involves the discretization of the irregular domain into smallerand regular subdomains, known as finite elements. This is equivalent to replacing thedomain having an infinite number of degrees of freedom by a system having finite number

Of degrees of freedom.

NODES AT DISCONTINUITIES

(a) Geometric
(b) Load
(c) Boundary conditions
(d) Material.

Geometric Discontinuities



Prepared: Dr. M. Subramanian/Professor & Head Aerospace Engineering

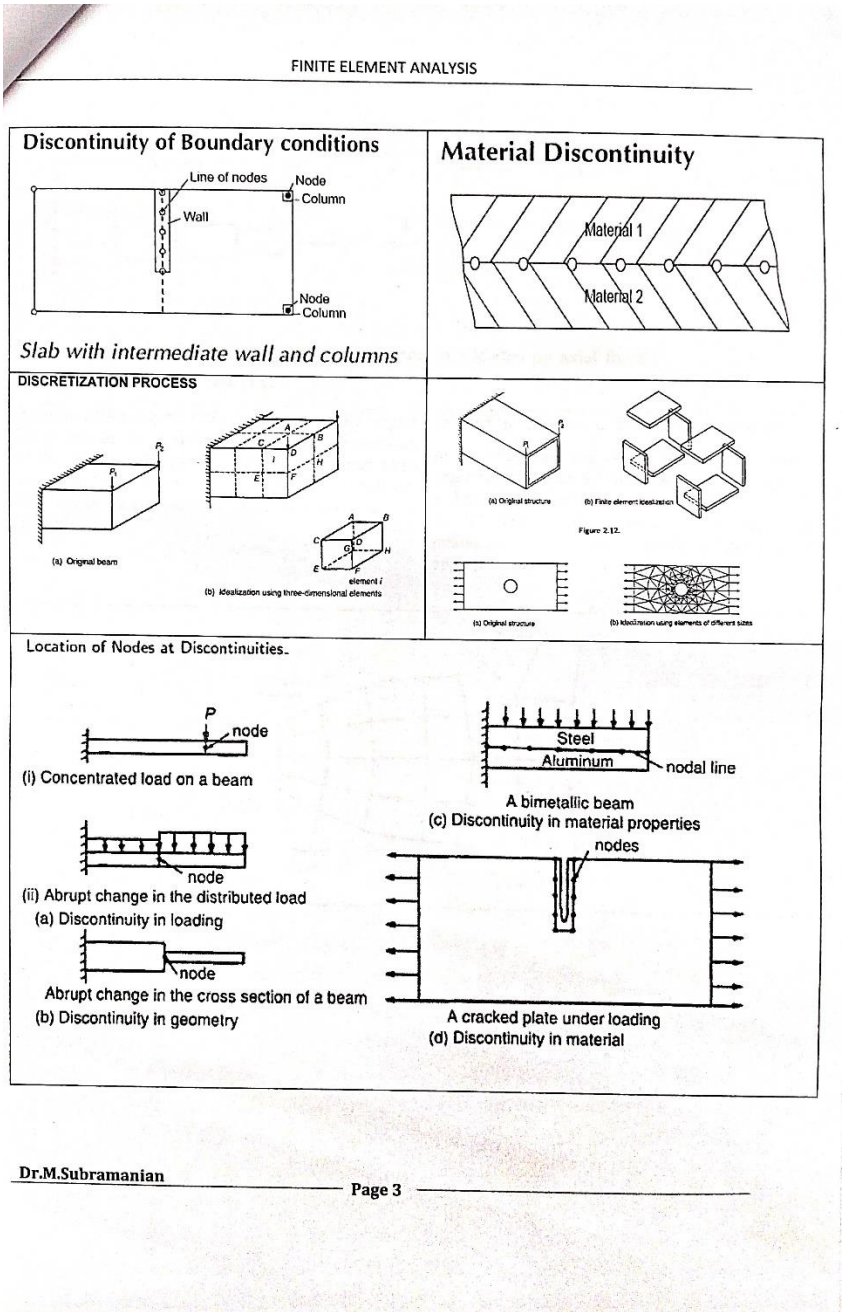
SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)
Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai
Accredited by NAAC-UGC with 'A++' Grade (Cycle III) &
Accredited by NBA (B.E - CSE, EEE, ECE, Mech & B.Tech.IT)
COIMBATORE-641 035, TAMIL NADU

DEPARTMENT OF AEROSPACE ENGINEERING

Faculty Name	:	**Dr.M.Subramanian, Prof & Head/ Aerospace**	Academic Year	:	**2024-2025 (Odd)**
Year & Branch	:	**III Aerospace**	Semester	:	**V**
Course	:	**19ASB302 – Finite Element Method for Aerospace**			

Unit: 1



Prepared: Dr. M. Subramanian/Professor & Head Aerospace Engineering

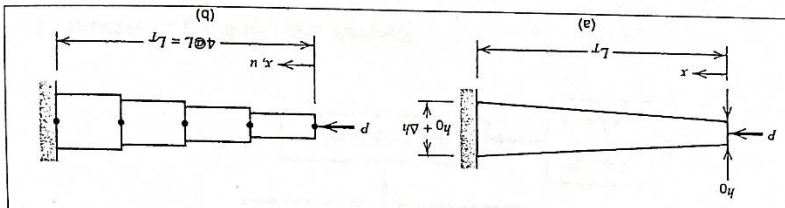
SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)
Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai
Accredited by NAAC-UGC with 'A++' Grade (Cycle III) &
Accredited by NBA (B.E - CSE, EEE, ECE, Mech & B.Tech.IT)
COIMBATORE-641 035, TAMIL NADU

DEPARTMENT OF AEROSPACE ENGINEERING

Faculty Name	:	**Dr.M.Subramanian, Prof & Head/ Aerospace**	Academic Year	:	**2024-2025 (Odd)**
Year & Branch	:	**III Aerospace**	Semester	:	**V**
Course	:	**19ASB302 – Finite Element Method for Aerospace**			

Unit: 1

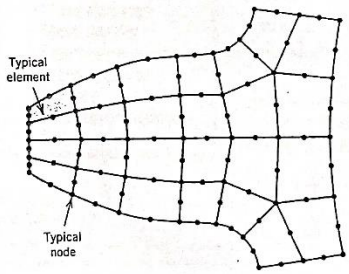


A tapered bar loaded by axial force *P*. A tapered bar loaded by axial force *P*.
uniform two-node elements of equal length..

Aspects ratio: Aspect ratio is the ratio of the largest dimension of the element to the smallest dimension of the element. In many cases, if the aspect ratio increases the inaccuracy of the solution increases. The aspect ratio should be close to unity as for as possible.

'h' and 'p' versions of finite element method

In 'h' version, the order of the polynomial approximation for all elements is kept constant and the number of elements increased.
In 'p' version the number of elements is maintained constant and the order of polynomial approximation of element is increased.



Prepared: Dr. M. Subramanian/Professor & Head Aerospace Engineering

SNS COLLEGE OF TECHNOLOGY

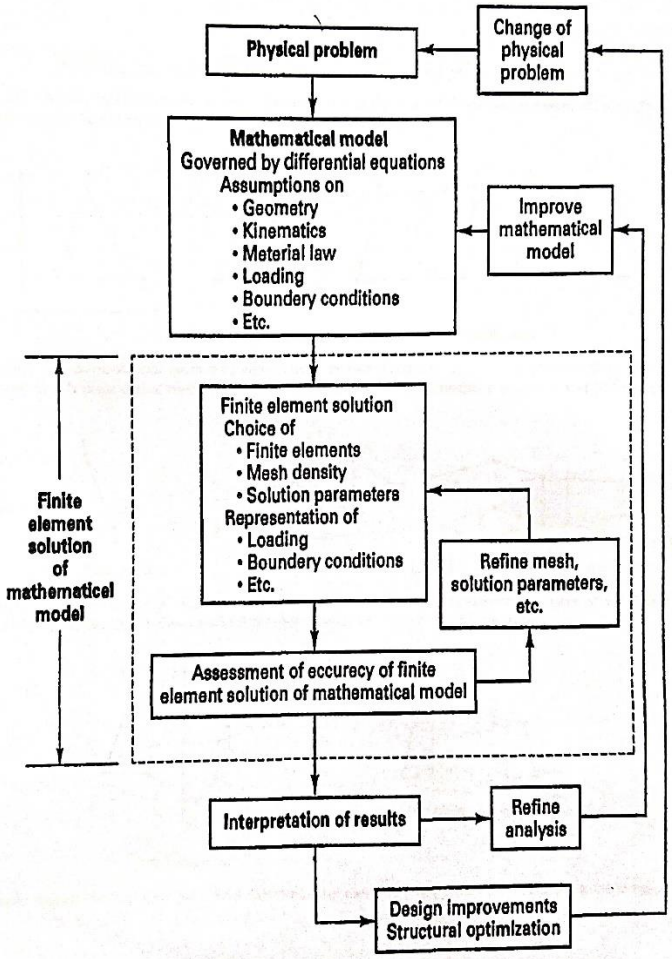
(An Autonomous Institution)
Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai
Accredited by NAAC-UGC with 'A++' Grade (Cycle III) &
Accredited by NBA (B.E - CSE, EEE, ECE, Mech & B.Tech.IT)
COIMBATORE-641 035, TAMIL NADU

DEPARTMENT OF AEROSPACE ENGINEERING

Faculty Name	:	**Dr.M.Subramanian, Prof & Head/ Aerospace**	Academic Year	:	**2024-2025 (Odd)**
Year & Branch	:	**III Aerospace**	Semester	:	**V**
Course	:	**19ASB302 – Finite Element Method for Aerospace**			

Unit: 1

The process of finite element analysis



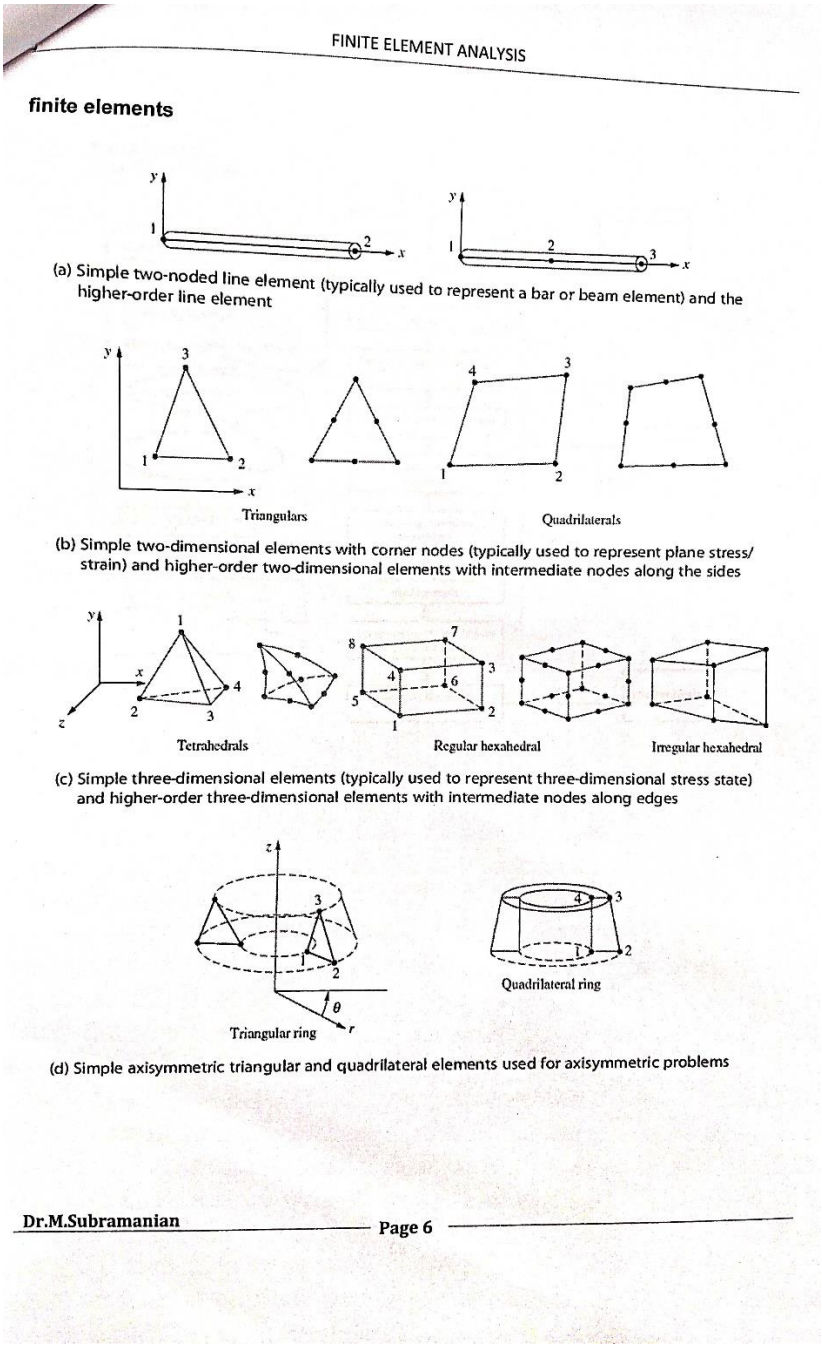
SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)
Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai
Accredited by NAAC-UGC with 'A++' Grade (Cycle III) &
Accredited by NBA (B.E - CSE, EEE, ECE, Mech & B.Tech.IT)
COIMBATORE-641 035, TAMIL NADU

DEPARTMENT OF AEROSPACE ENGINEERING

Faculty Name	:	**Dr.M.Subramanian, Prof & Head/ Aerospace**	Academic Year	:	**2024-2025 (Odd)**
Year & Branch	:	**III Aerospace**	Semester	:	**V**
Course	:	**19ASB302 – Finite Element Method for Aerospace**			

Unit: 1



(a) Simple two-noded line element (typically used to represent a bar or beam element) and the higher-order line element

(b) Simple two-dimensional elements with corner nodes (typically used to represent plane stress/ strain) and higher-order two-dimensional elements with intermediate nodes along the sides

(c) Simple three-dimensional elements (typically used to represent three-dimensional stress state) and higher-order three-dimensional elements with intermediate nodes along edges

(d) Simple axisymmetric triangular and quadrilateral elements used for axisymmetric problems

SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)
Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai
Accredited by NAAC-UGC with 'A++' Grade (Cycle III) &
Accredited by NBA (B.E - CSE, EEE, ECE, Mech & B.Tech.IT)
COIMBATORE-641 035, TAMIL NADU

DEPARTMENT OF AEROSPACE ENGINEERING

Faculty Name	:	**Dr.M.Subramanian, Prof & Head/ Aerospace**	Academic Year	:	**2024-2025 (Odd)**
Year & Branch	:	**III Aerospace**	Semester	:	**V**
Course	:	**19ASB302 – Finite Element Method for Aerospace**			

Unit: 1

Procedure of FEM
Steps followed in FEM