

Task №4

3D STRUCTURAL, THERMAL and THERMOELASTIC ANALYSES

Individual tasks – bodies in the shape of letters.

Consider a 3D domain in the shape of the given letter from practical assignment 2 and table 1. The objective is to perform different types of analyses, namely, structural, thermal and thermoelastic (separately). A 3D domain should be created by rotation, parallel transfer or extrusion (parallel transfer with scale change) of a plane domain along given line. Take the geometrical dimensions of the letter similar to those of the example problem. If possible, take advantage of symmetry when building the domain. Consider the body to be made of any elastic isotropic material.

Thermal analysis (thermal conductivity problem, **analysis A1**): the bottom edges of the letter should be subjected to heating with prescribed temperature values and the top edges should be subjected to heat transfer.

Structural analysis (problem of linear elasticity theory, **analysis A2**): the bottom edges should be rigidly fixed and the top edges should be subjected to tension (stretching surface load).

Coupled thermoelastic analysis: only thermal boundary conditions (thermal stress calculation, **analysis A3**) or both thermal and structural boundary conditions (**analysis A4**).

Perform computations in ANSYS and analyze the results. Compare results for tetrahedral mesh (10-node tetrahedron with midside nodes) and hexahedral mesh (consider both linear 8-node and quadratic 20-node hexahedrons). Additionally compare computation time (see attached file with relevant commands).

Requirements to the report.

The report should contain the name of the student, the full description of the problem and the results obtained in ANSYS. Text of input files should be also included in the report.

Provide the following computation results:

- finite element mesh with boundary conditions
- nodal degree of freedom solution (temperature for thermal analysis, displacements for structural analysis)
- pictures of the distribution of the heat flux vector and its magnitude (for thermal analysis)
- pictures of the distribution of the displacement vector and its magnitude (for structural analysis)
- optional: pictures of the distribution of the axial stresses (for structural analysis)
- picture of the stress intensity distribution (for structural analysis)

Table 1. Suggestions for domain shape

Here R is rotation (VROTAT command); D is parallel transfer (VDRAG command); E is extrusion, or parallel transfer with scale change (VEXT command).

Odd task numbers correspond to odd numbers of analyses (A1 and A3). Even task numbers correspond to even numbers of analyses (A2 and A4).

Variant No.	Way to construct 3D structure	Domain shape	Student name
1.	R	α	Губанов Александр Сергеевич
2.	D	β	Догаев Никита Сергеевич
3.	E	δ	Завялкин Денис Витальевич
4.	R	ε	Катасонов Никита Андреевич
5.	D	θ	Кириллова Елена Владимировна
6.	E	ω	Крабченко Руслан Андреевич
7.	R	λ	Лушпанов Андрей Александрович
8.	D	μ	Непряхин Даниил Олегович
9.	E	ρ	Петров Илья Сергеевич
10.	R	σ	Половинкина Дарья Александровна
11.	D	τ	Ражук Никита Викторович
12.	E	φ	Ривкин Михаил Борисович
13.	R	χ	Сенчукова Ангелина Александровна
14.	D	ψ	Степанова Ирина Александровна
15.	E	ϕ	Федоров Юрий Владимирович
16.	R	θ	Филоненко Никита Сергеевич
17.	D	S	Шагал Анастасия Михайловна
18.	D	D	Щукин Константин Вадимович
19.	R	G	Kamps Jeroen