# 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). Optional: 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**

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 (A 1 and A3). Even task numbers correspond to even numbers of analyses (A2 and A4).

**Программа ММ (математическое и программное обеспечение вычислительных машин) – все**

| | Способ получения 3D-конструк-ции | Вид области | ФИО студента |
|---|---|---|---|
| 1. | R | α | Битюцкий Михаил Сергеевич |
| 2. | D | β | Борисенко Иван Алексеевич |
| 3. | E | δ | Бротский Ярослав Игоревич |
| 4. | R | ε | Васильев Андрей Владимирович |
| 5. | D | θ | Говорина Людмила Андреевна |
| 6. | E | ω | Гончаров Андрей Сергеевич |
| 7. | R | λ | Григорян Арутюн Камоевич |
| 8. | D | μ | Ефимов Виктор Александрович |
| 9. | E | ρ | Затона Дмитрий Дмитриевич |
| 10. | R | σ | Золотов Никита Борисович |
| 11. | D | τ | Зубков Юрий Николаевич |
| 12. | E | φ | Каренькова Ирина Васильевна |
| 13. | R | χ | Коновалов Артем Дмитриевич |
| 14. | D | ψ | Лавуренко Илья Вениаминович |
| 15. | E | ϕ | Морозова Юлия Александровна |
| 16. | R | ϴ | Резван Семен Андреевич |
| 17. | D | S | Рожковецкий Александр Олегович |
| 18. | D | D | Саямов Сергей Михайлович |
| 19. | R | G | Таранов Даниил Николаевич |
| 20. | D | J | Храмцов Максим Валерьевич |
| 21. | E | Q | Чуб Анастасия Сергеевна |
| 22. | R | Б | Чубенко Иван Николаевич |
| 23. | D | В | Шалимов Антон Валерьевич |
| 24. | E | З | Петренко Дарья |