Laboratory work №3
CALCULATION OF NATURAL FREQUENCIES AND STEADY-STATE OSCILLATIONS
Individual assignments

Individual assignments – plates in shape of letters.

Part 1. Consider a problem of a plate tension for a plate in the shape of the letter from practical assignment 1 (without a hole and without symmetry). The bottom edges of the letter should be rigidly fixed. Take the geometrical dimensions of the letter similar to those of the example problem. Consider the plate to be made of two different elastic isotropic materials, dividing the plate horizontally half by half. The objective of Part 1 is to conduct modal analysis in the assumption of plane stress state, compute several first natural frequencies and obtain modes shapes at these frequencies.

Part 2. For the model from Part 1, choose a frequency interval where one or two resonance frequencies can be located. Perform harmonic analysis and obtain amplitude-frequency response at the considered interval. Set such load factors that could excite one or two oscillation mode shapes, obtained in modal analysis (in Part 1). Compare different types of loading (different directions and load points) to determine how the load factor affects the results of the resonance frequency calculation and the deformed shapes. Obtain the graphs of amplitude-frequency response at the node with concentrated load and at the node without load. From the graphs of amplitude-frequency response, find the resonance frequencies. Show the pictures of the deformed shapes at resonance frequencies and compare them with the pictures of the mode shapes obtained in Part 1.

Perform computations in ANSYS (command mode) and in FlexPDE, and compare the results. Check the convergence (accuracy of the natural and resonance frequency calculation) by varying the mesh density. Analyze the results, make conclusions and present a report.

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 and in FlexPDE. Text of input files for ANSYS and FlexPDE should be also included in the report.

Provide the following computation results:

- finite element mesh with boundary conditions (for modal and harmonic analyses)
- results on the natural frequencies calculation
- pictures of the mode shapes
- graph of amplitude-frequency response for given nodes
- results on the resonance frequencies calculation
- pictures of the deformed shapes at the resonance frequencies
- analyze convergence of the natural and resonance frequencies for different mesh size (present results in a table or a graph)
- make conclusions on optimal mesh size, make any other conclusions you would like to add

Table 1. Suggestions for the domain shape.

Variant No.	Domain shape	Student name
1	N	Бежжа Абир
2	F	Мабиала Детати Селест Стефен
3	A	Кашу Салуму Кисангаси
4	W	Киспе Зурита Эстебан Франсиско
5	X	Хоссаин Фархад
6	Z	Чжан Фан