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| Project Title: | MECHANICAL PERFORMANCE OF A SOFA FRAME CONSTRUCTED WITH AUXETIC JOINTS |
| Project Coordinatior: | Prof. Dr. Ali Kasal |
| Project Abstract: | Novelty: In this project, it was aimed to design auxetic fasteners for sofa frames, and determine and evaluate mechanical behavior of real size sofa frames constructed by designed fasteners. Interest in auxetic materials has been increasing in recent years; therefore, experimental and theoretical modelling based studies on these materials have become widespread. Superior mechanical properties provided by negative Poisson ratio, which has an effect on many fundamental properties of materials. Thus, auxetic materials encourage researches on utilization of them in engineering applications. Auxetics have extra friction resistance, high shear modulus, superior energy absorption, acoustic behavior, high tensile strength, adhesion resistance, thermal shock resistance, and thermal impact resistance, etc. compared to conventional materials. Accordingly, auxetic behavior can be seen as a new step in production of high value added materials, and this feature can be applied to different materials, allowing the design and production of new materials with superior behavior and properties than existing materials. The number of national and international studies on the application of these materials in the furniture industry is very limited. In particular, no study has been found in which auxetic fasteners were tested in frame construction furniture joints such as chairs and sofa frames. In conclusion, design and production of fasteners used in sofa frame joints with auxetic materials and evaluate on of their strength will be a unique work.  Method: Dowel was chosen as fastener. In the study, dowel designs with cross section configurations in different auxetic geometries will be made. Dowels will be modeled in 3D, then their cross sections will be optimized and after the numerical analyses they will be produced with a 3D printer. In experimental phase, all steps of furniture engineering will be followed. Therefore; firstly, physical and mechanical properties of materials will be determined, then all joints that create the system will be tested, and finally performance tests of entire sofa system will be carried out. Scotch pine as solid wood and 20 mm thick poplar plywood will be used in production of sofa frames, and PLA, ABS, and ASA filaments will be used for 3D printing of the dowels. Dowels will be subjected to withdrawal tests in order to determine their holding strength from wood and wood based materials. Then, using the best performing dowels, individual joint specimens representing sofa frame joints will be prepared and tested under static loads according to loading forms they will be exposed to during usage. Then, the sofa frames constructed with auxetic dowels will be tested with cyclic loading specified in FNAE-80 214 standard; thus, their performance will be determined.  Management: This project will be carried out as a PhD thesis and PhD. student will work in project on a researcher. Project team consists of thesis supervisors, thesis monitoring committee members and other researchers. The foreign supervisor in the team is first researcher in the world to use auxetics in furniture engineering. In addition, project manager conducted some studies on auxetics with foreign researcher. Other researchers are also experts in furniture engineering and mathematical modeling. Project team includes experts on all studies to be carried out, and 1 doctoral 2 undergraduate scholars will also work.  Impact: In ever-increasing global competition, promising potential of auxetic materials should not be ignored for furniture industry. It is aimed to obtain a patent for auxetic dowels developed in the project. As a result of the research, significant contributions will be provided to the Turkish Furniture Industry. In order to increase the impact of project in the furniture industry, a letter of support was received from BELLONA furniture company. In addition, the project's outputs will be promoted at national/international fairs with the company. |
| Students in the Project: | PhD. St., MSc.Student 1, MSc. Student 2 |