The objective of the project is to generate new knowledge about the structure and properties of three-dimensional (3D) elements applied onto a textile fabric to determine the effects of their geometric parameters on cut resistance properties.

Tasks involving sharp implements pose a risk of hand injury due to cuts or stabs. It is estimated that in Poland approximately 1 million people come in contact with sharp objects at work. One way of preventing injury is for the workers to wear protective products made from certified cut resistant textile materials. New products are being developed on the basis of user needs and preferences. As a result of the development of hybrid materials combining textile fabrics and polymeric elements and exhibiting new functional properties, there has been considerable interest in textile materials with 3D structures, which could offer better protection against such injuries. Knowledge of the physical properties of hybrid textile materials is essential in modeling and designing improved structures with superior functional properties. Knowledge about the cut resistance of textile fabrics is equally important as products made from them can form an effective barrier between the human body and sharp objects

The subject matter of the study will be textile fabrics with 3D surfaces obtained by the application of polymeric materials using pattern matrices with various geometries. In accordance with the adopted research methodology, the evaluation of geometric elements will be optimized using contactless (optical) measurement techniques to characterize their surface and create topographic maps. In addition, the cut resistance properties of 3D surfaces will be assessed by means of both circular and linear blades. The results of cut resistance tests will be used in conjunction with numerical simulations to establish the effects of geometrized 3D surfaces on cut resistance properties. This will not only generate important data, but also allow an in-depth understanding of the cutting mechanism.

The findings will contribute to scientific development in many areas due to the interdisciplinary nature of the project. In addition to the fields already mentioned, the results will further the methodology of evaluating the geometric parameters and cut resistance properties of 3D structures, as previous research has been solely devoted to 2D structures. The obtained results may also be useful in textile engineering, physics, chemistry, and materials sciences. New insights into the processes and mechanisms in question are also of paramount social importance in terms of the production of cut resistant materials in the hope of providing superior protection to a greater number of people. The project’s findings will be published in scientific journals and presented at national and international conferences.