The development of new fruit varieties resistant to damages during collecting, transport and storage processes contributes to reducing losses and production demand, thereby contributing to reducing financial and environmental costs. The new Chopin variety comes from one of the most recognized varieties in the world - Granny Smith. It has a chance to become very popular because of its high acidity, which delays the maturing process, so it can be stored for a long time. An additional advantage of the Chopin variety is that it fruits very rich. Nevertheless it is necessary to determine the micromechanical properties of this apple in order to compare it with other varieties.

Based on the micromechanical properties the three-dimensional (3D) discreet models, called Finite Element Models (FEM), can be created. 3D fruit models, are able to very accurately reflect the behavior of the material in empirical tests. However, the available models of fruits do not describe the actual structure of the biological material, but only show the response of a specific material to a given impulse. Biochemical parameters along with micromechanical properties of tissues and cells have never been studied in a comprehensive manner considering all stages of fruit ripening, hence it is not possible to make models based on literature data. Therefore, it is necessary to determine these properties in order to design a model whose parameters will change depending on the given stage of fruit ripeness, considering loading speed. The research, enriched by the cellular level of the parenchyma tissue, will enable a deeper analysis why the material behaves in a more viscoelastic way at low loading speeds, while as the loading speed increases the material behaves more elastically.

The aim of the project is to make 3D (FEM) models of apples at the cellular and tissue level for individual stages of fruit ripening and to determine the model of change in their resistance to various types of stress. The project will investigate the strength properties of cell walls, tissues and whole fruit. At the same time, research will be conducted to determine the level of fruit ripeness. On this basis, 3D (FEM) models of the fruit will be made, at the tissue and cellular level, for the development, ripening and senescence stages. These models will then be used to determine the model of material behavior during the ripening process. Based on the model it will be possible to determine the resistance to damage of the fruit at a random stage of its development. Validation of the models will be performed using microtomographic images to determine fruit tissue damage and a map of the surface pressures exerted by the fruit in the compression test.

The proposed discreet model may contribute to the dissemination of a new Polish variety, bred by Emilian Pitera from Warsaw University of Life Sciences (SGGW). Furthermore, such research may initiate their implementation in other fields of science, such as biomaterial engineering or medicine.