

SELECTED ISSUES OF NUMERICAL MODELING AND EXPERIMENTAL STUDIES IN THE DESIGN OF BIORESORBABLE STENTS

ABSTRACT

This dissertation presents selected issues of numerical modelling and experimental studies in the design of biodegradable stents. The scope of the study included the design of the geometric form of the stent, in a way that allows the correct operation of the endovascular prosthesis, followed by experimental mechanics studies – mapping the loads to which the stents are subjected during the implantation process and in the period after placement in the artery. Verification of the proposed geometrical forms was carried out by means of numerical simulations and experimental studies. In terms of numerical simulations, the finite element method was used. On the other hand, for experimental testing, typical tests used in mechanical testing were used, modifying the techniques for measuring displacements and observing the deformation state. To this end, an original approach was used – the Digital Image Correlation (DIC) method and its latest variation allowing the measurement of micro-sized objects, the micro Digital Image Correlation (microDIC) method.

A new universal stand for measuring displacements and deformations at the micro scale was developed and tested. The research carried out demonstrated the effectiveness of the proposed two-step design method and the usefulness of numerical simulations in the modelling and design of biodegradable stents. In terms of experimental research, the implementation of the digital image micro-correlation method for the study of endovascular prostheses characterized by micro dimensions was carried out. The conducted research is a new contribution to the field of design, experimental research and numerical simulations in mechanical engineering.