Evaluation of the accuracy of soft tissue computational model in Blender on basis of comparison to FEM simulation and experimental data

Elena Alida Brake[1], Yordan Kostadinov Kyosev[2], Katerina Rose [1]
[1]*Reutlingen University, Reutlingen Research Institute, Reutlingen, Germany*
E-mail: elena.brake@reutlingen-university.de, katerina.rose@reutlingen-university.de
[2]*Institute of Textile Machinery and High Performance Material Technology, Technische Universität Dresden, Dresden, Germany, E-mail*: yordan.kyosev@tu-dresden.de

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When wearing compressive garments, the tissue of the human body is altered in relation to its natural shape by the properties of the applied material and by the pattern construction used [1]. To check the fit of garments, both construction and selected materials can be virtually simulated in 3D on avatars in corresponding CAD programs before fabrication. The avatars on which the clothing is simulated can be changed individually, but the surface of the avatars in clothing CAD programs are always solid and non-deformable. A virtual fit check thus only shows the distance of the material to the avatar as well as areas of tension and stretch, but not whether and how the shape of softer tissue of the human body is deformed by the clothing. [2] To actually verify the fit of shape-changing garments, it is necessary for the avatars not to simulate a continuous hard surface, but to conform to the physical properties according to real human tissue as well as deform through the developed pattern and simulated material properties as the pressure on the body through the garment.
The software Blender allows the modelling of an avatar and to generate in respective to the different tissue zones with their specific properties to adjust them with soft body physics according to the testing of real soft tissue but the models in Blender are mainly using linear springs [3]. To verify and test the generated soft tissue in Blender, it is necessary to compare the settings according to the material laws of non-linear mechanical properties like Neo-Hookean with a material and human model of a FEM software as Abaqus to validate them [4]. The experimentally obtained curves for the deformation-pressure behaviour are used to fit the material parameters for the models in Blender and Abaqus so that by an experimental compression of the modelled soft tissue the simulation results could be compared to validate that the physical soft body physics in Blender are suitable for the simulation of soft tissue. [5,6]

References

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