Numerical Simulation Added Design of Wide Angle Lens using Soft Materials

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For arthropods, they have a remarkably sophisticated class of imaging system during the evolution. Their imaging system has wide angle field of view, low aberrations, high acuity to motion and infinite depth of field1. The challenge our faced is how to build a digital cameras with the hemispherical, compound apposition layouts of arthropod eyes. The traditional design is based on the planar sensor technologies and conventional optics, which is cannot be met with existing requirements. The ideas presented here is that use soft materials to make arthropod-inspired lens in nearly full hemispherical shapes and integrate into apposition cameras. The devices combine elastomeric compound optical elements with deformable arrays of thin silicon photodetectors, in co-integrated sheets that can be elastically transformed from the planar geometries. Hemispherical apposition design enables exceptionally wide angle fields of view, without off-axis aberrations. In materials, mechanics and integration schemes, numerical simulation studies reveal key aspects of the materials science and physics of these systems. The simulation results are used to study the mechanical and geometrical effects. Imaging results and quantitative ray-tracing based modeling illustrate essential features of their operation. These general strategies appear applicable also to other classes of compound eye devices. The numerical approach is one of powerful design tools, it allow engineers to construct stretchable structure for different applications.

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