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Corneal Material Characterisation via PINNs-Based Modelling of Impinging Jets

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Models of the fluid-structure interaction (FSI) model for the air puff test were analysed. Using Abaqus, the air puff test is applied to eyes with varying biomechanical parameters, such as material properties, corneal thickness, and radius. A reduced order model of the air puff (a turbulent impinging jet) has been acquired to decrease simulation time from 48 hours for the FSI model to approximately 12 minutes for the finite element analysis (FEA) model alone [1, 2]. To further accelerate simulations and improve model accuracy, Physics-Informed Neural Networks (PINNs) will be integrated with the reduced-order model. This hybrid approach will help expand the model to a larger dataset, enhancing intraocular pressure (IOP) estimation accuracy and the corneal material properties algorithm through inverse FEA, see Figure 1.

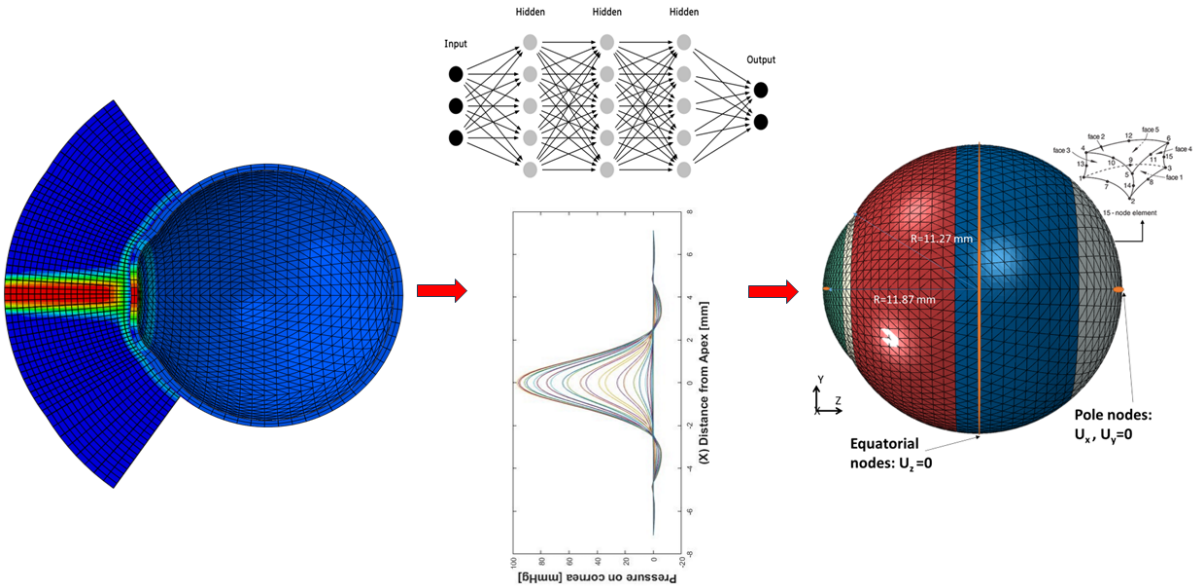

Figure 1: The FSI coupled model of the air puff test with the boundary conditions along with the proposed PINNs implementation.

References

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