

Numerical experiment 10

Material parameters:

Os - corticalis:

Young's modulus $E = 1,71 \times 10^{10}[\text{Pa}]$ and Poisson's ratio $\nu = 0,25$.

Os - spongy:

Young's modulus $E = 1,4 \times 10^{10}[\text{Pa}]$ and Poisson's ratio $\nu = 0,3$.

Os - pulp:

Young's modulus $E = 2 \times 10^6[\text{Pa}]$ and Poisson's ratio $\nu = 0,45$.

Ligament:

Young's modulus $E = 7 \times 10^4[\text{Pa}]$ and Poisson's ratio $\nu = 0,5$.

(1) Ti6Al4V:

Young's modulus $E = 1,15 \times 10^{11}[\text{Pa}]$ and Poisson's ratio $\nu = 0,3$.

(2) Chirulen:

Young's modulus $E = 3,4 \times 10^8[\text{Pa}]$ and Poisson's ratio $\nu = 0,4$.

(3) CoCrMo:

Young's modulus $E = 2,08 \times 10^{11}[\text{Pa}]$ and Poisson's ratio $\nu = 0,3$.

Boundary conditions:

Model I-V

Prescribed zero displacement on 1-2, 3-4.

Unilateral contact boundary on 5-6, 7-8, 9-10.

Pressure $2,15 \times 10^6[\text{Pa}]$ on 11-12, 13-14.

Discretization statistics:

Model I (angle 0° between axis of femur and mechanical axis)

1681 nodes, 2982 elements,

Model II (angle 3° between axis of femur and mechanical axis)

1678 nodes, 2974 elements,

Model III (angle 5° between axis of femur and mechanical axis)

1684 nodes, 2984 elements,

Model IV (angle 7° between axis of femur and mechanical axis)

1676 nodes, 2977 elements,

Model V (angle 9° between axis of femur and mechanical axis)

1671 nodes, 2965 elements,

Model I-V

16 subdomains, 33+33+8 unilateral contact conditions, 384 interface elements.

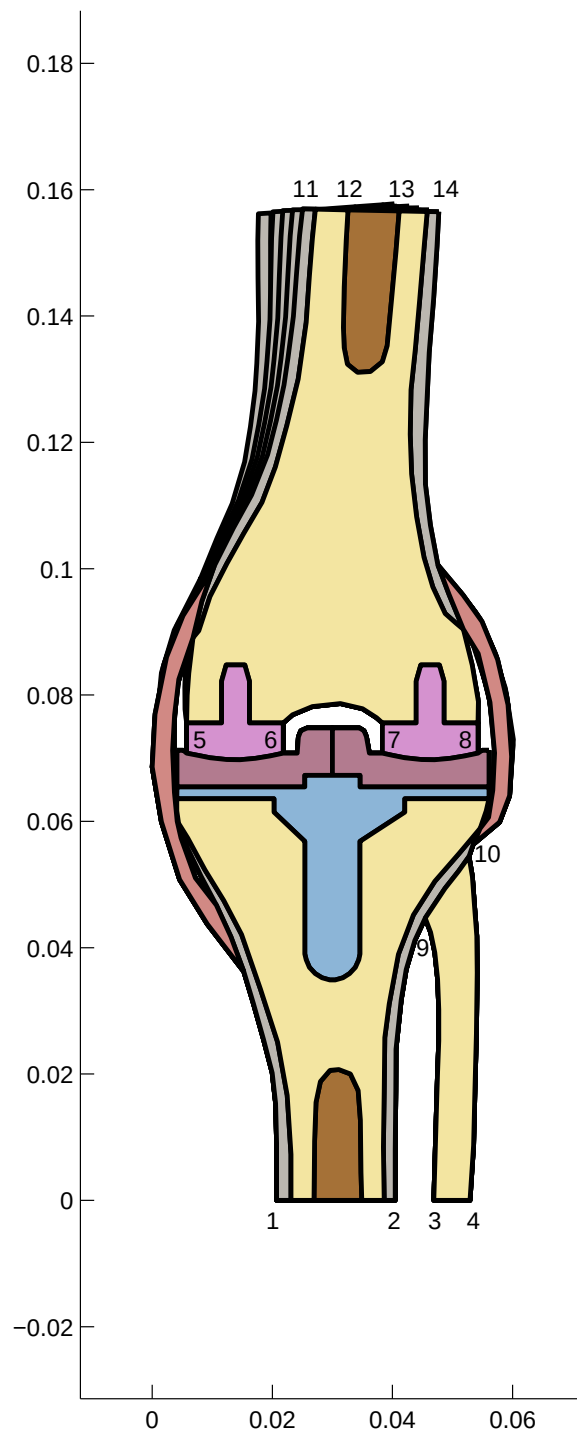


Figure 1: The geometry of the models I-V

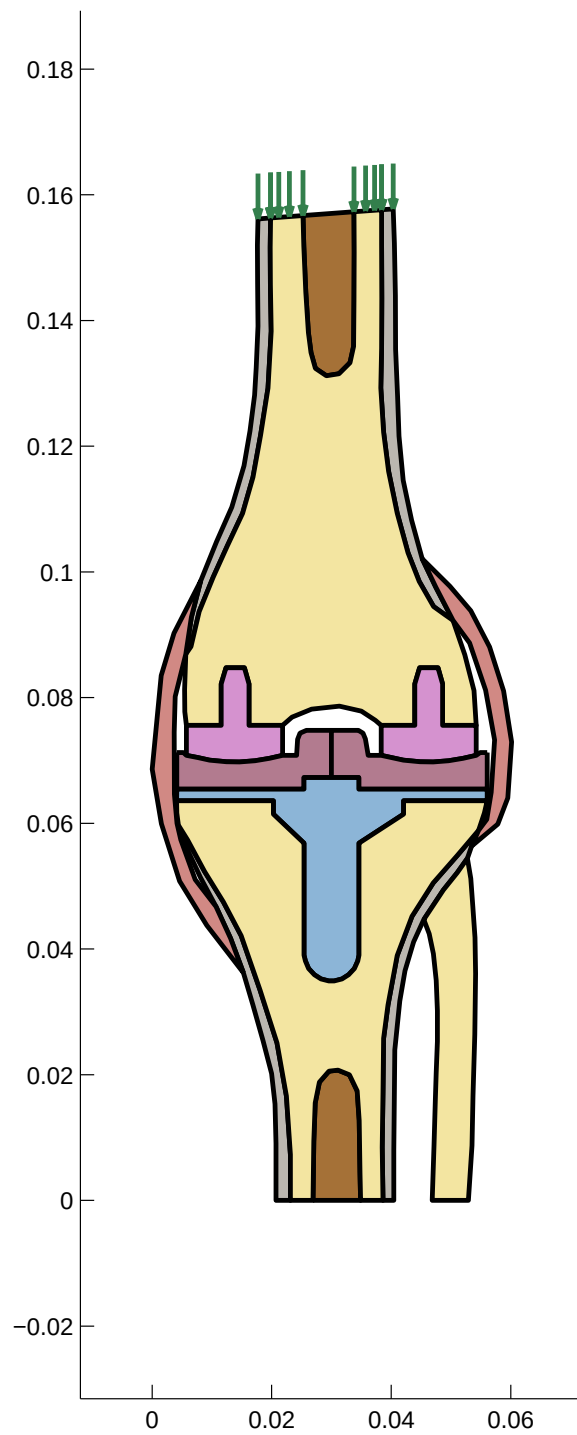


Figure 2: The geometry of the model I

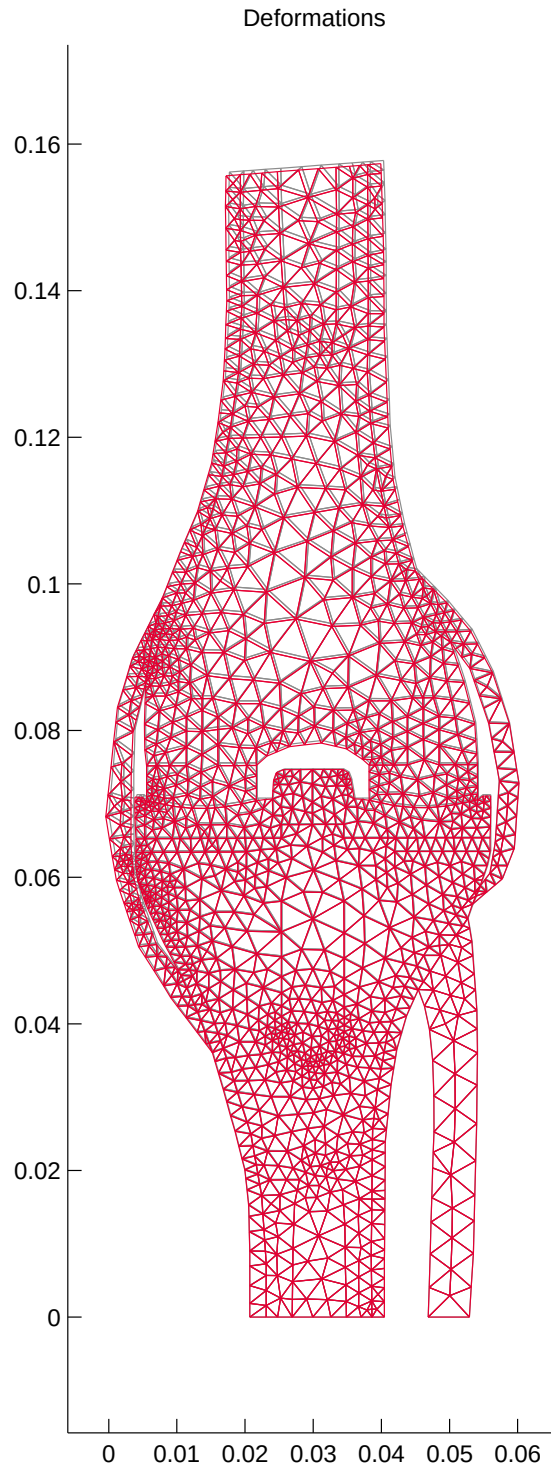


Figure 3: Model I - Deformations (enlarge factor=20)

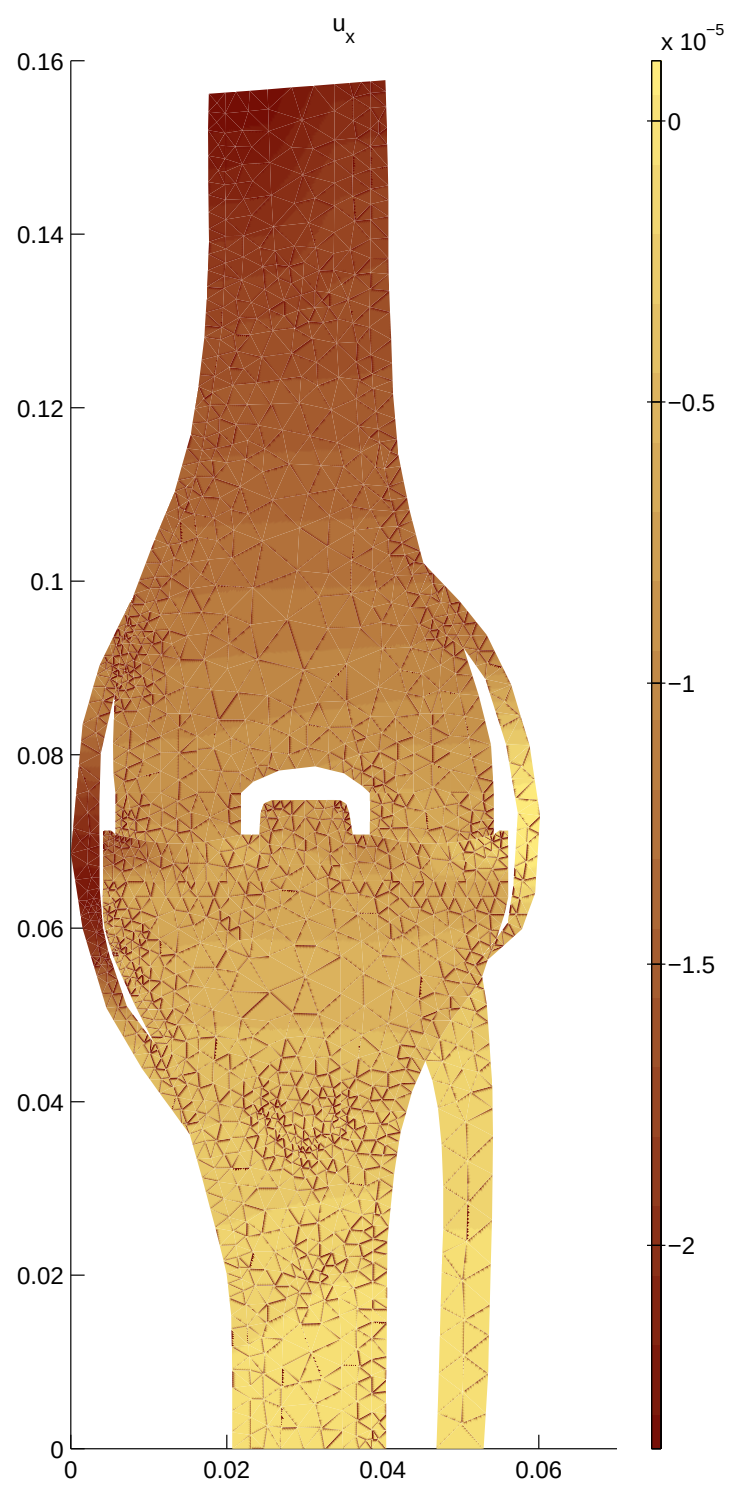


Figure 4: Model I - Horizontal component of displacement

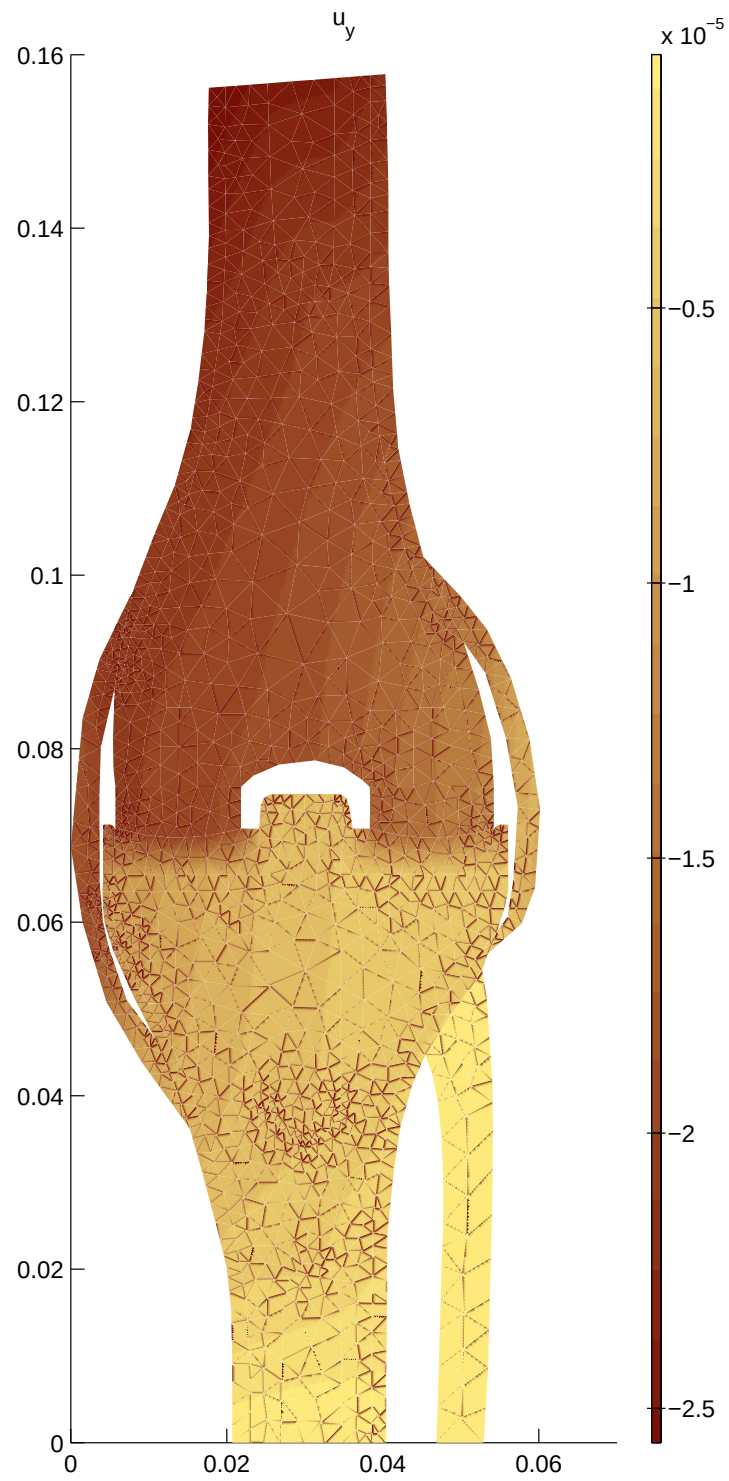


Figure 5: Model I - Vertical component of displacement

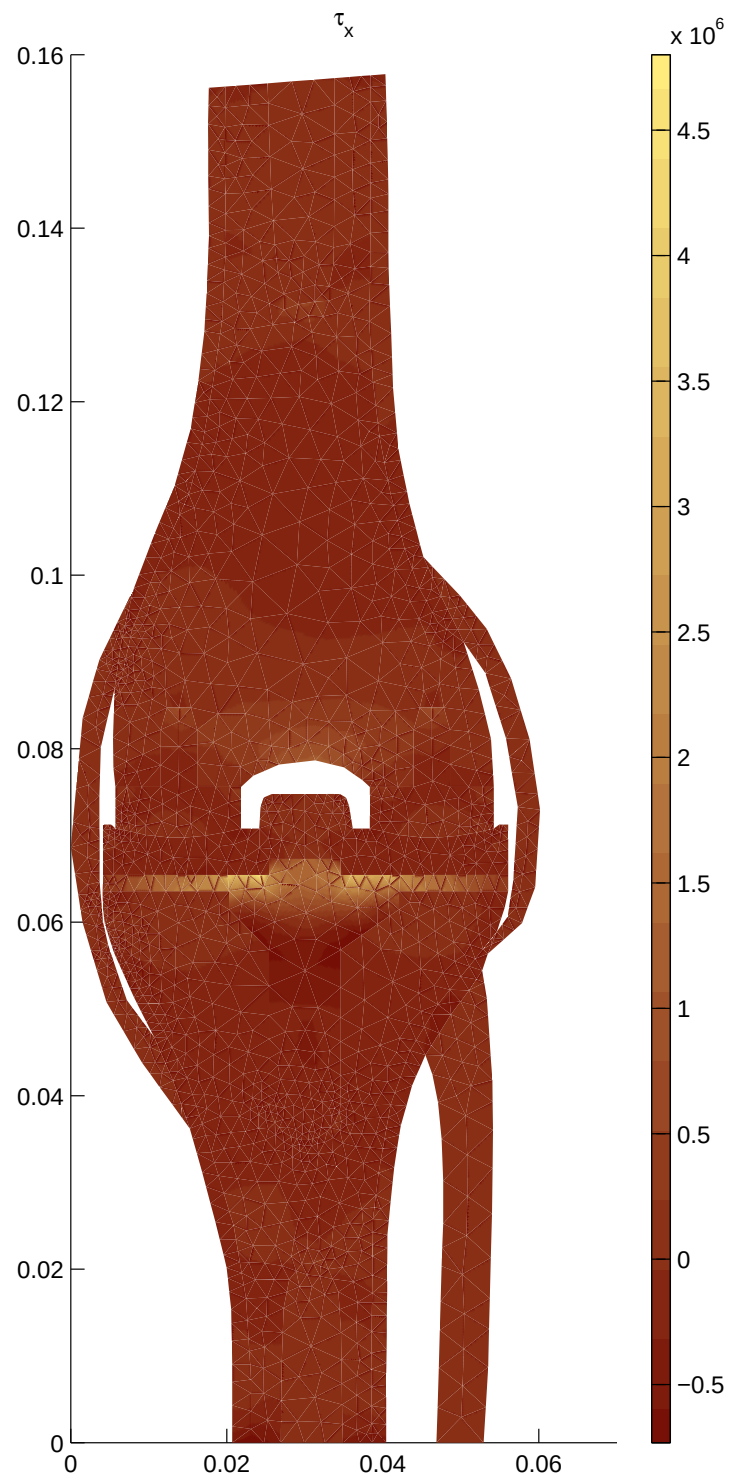


Figure 6: Model I - Stresses τ_x

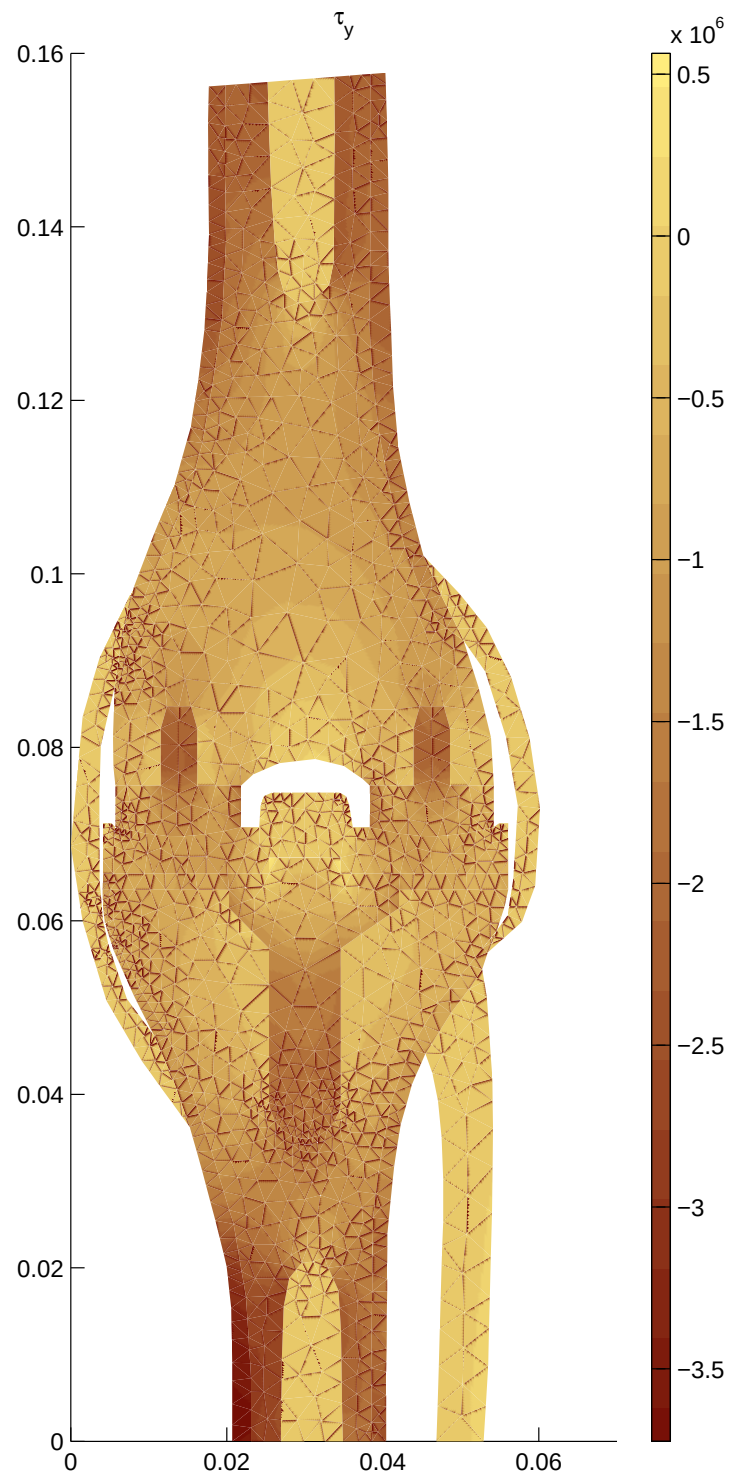


Figure 7: Model I - Stresses τ_y

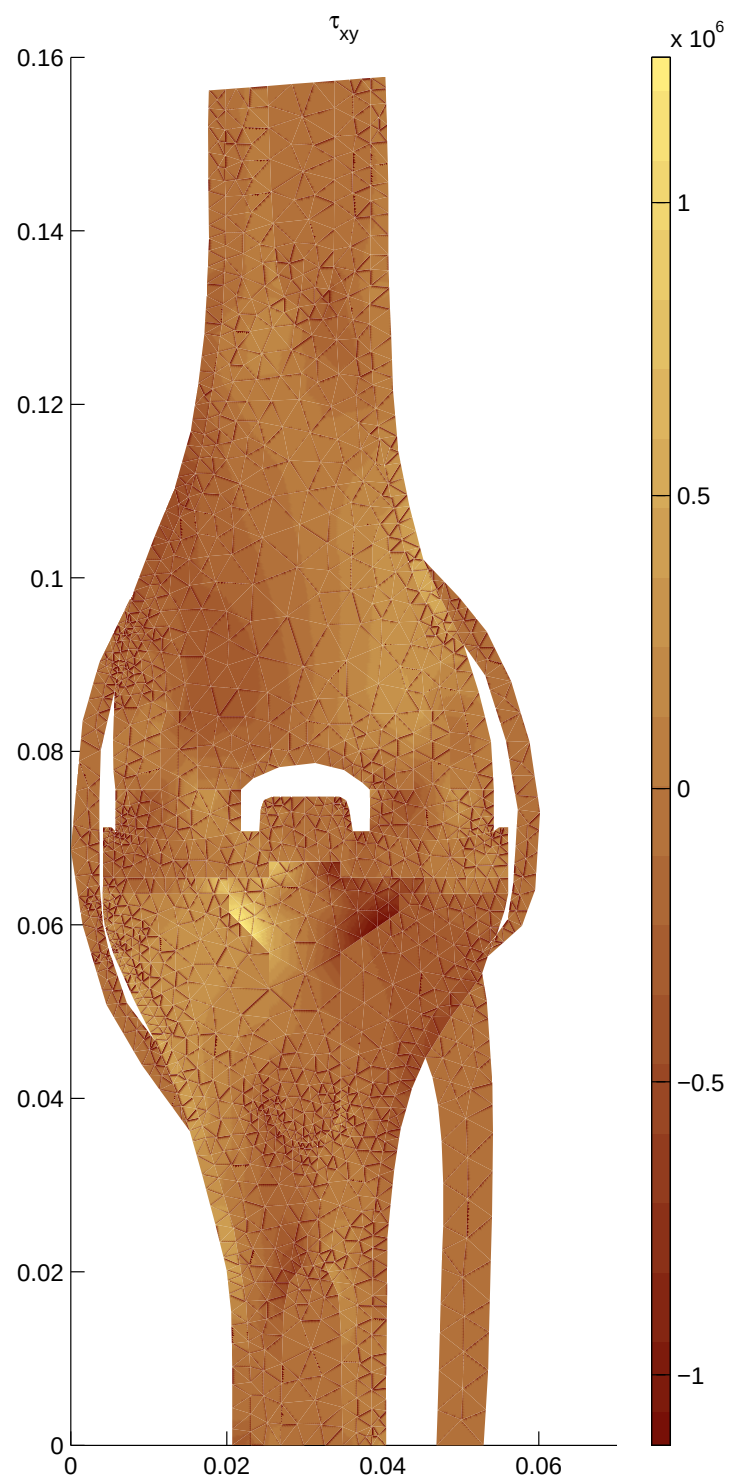


Figure 8: Model I - Stresses τ_{xy}

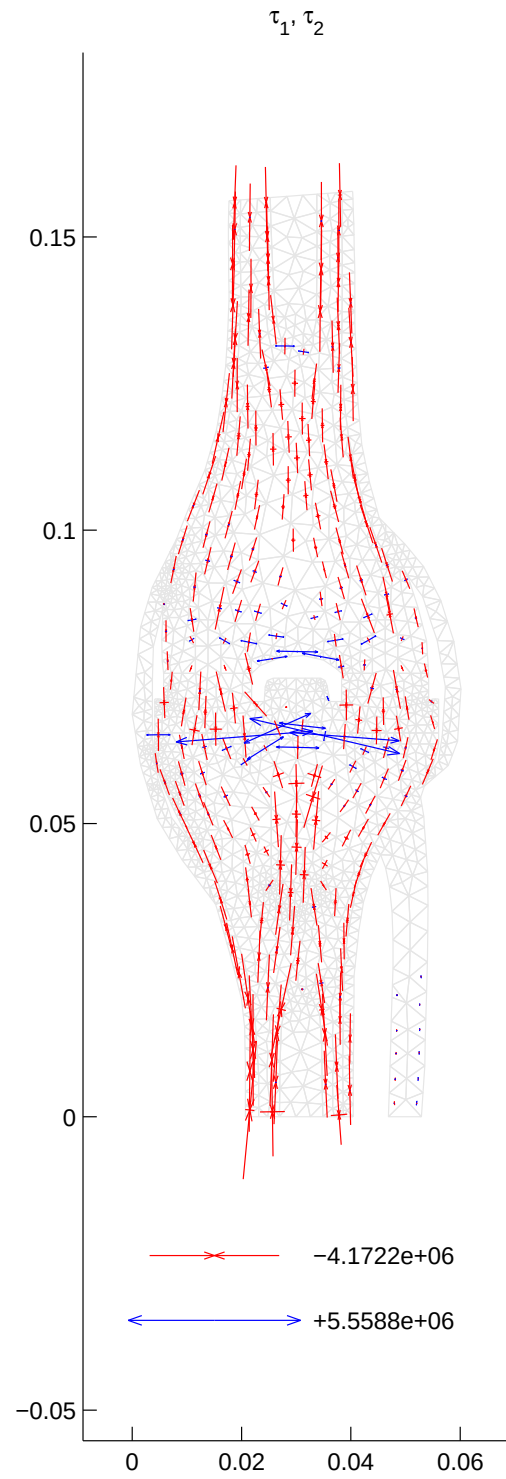


Figure 9: Model I - Principal stresses

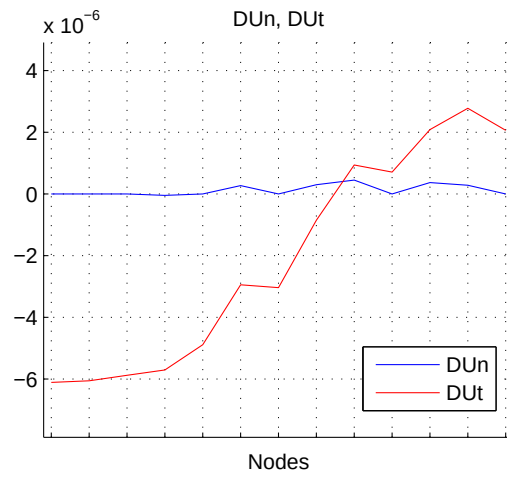


Figure 10: Model I - The normal and tangential components of displacement on the contact boundary 5-6

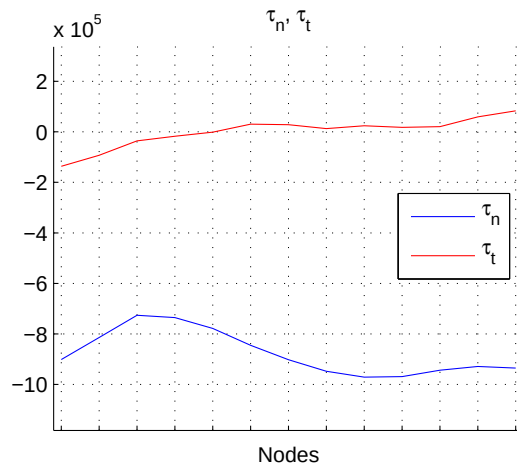


Figure 11: Model I - The normal and tangential components of stress vector on the contact boundary 5-6

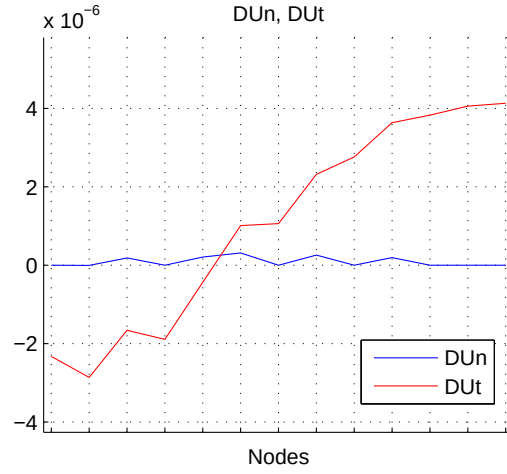


Figure 12: Model I - The normal and tangential components of displacement on the contact boundary 7-8

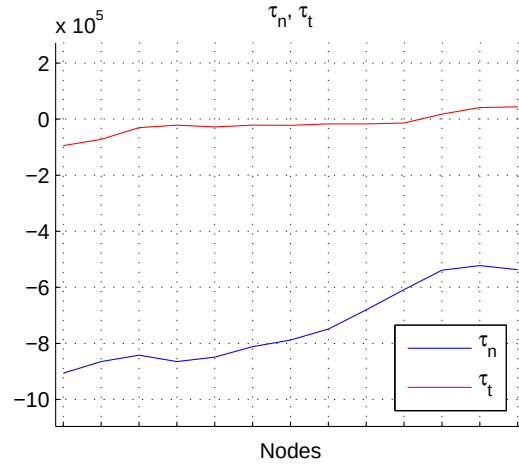


Figure 13: Model I - The normal and tangential components of stress vector on the contact boundary 7-8

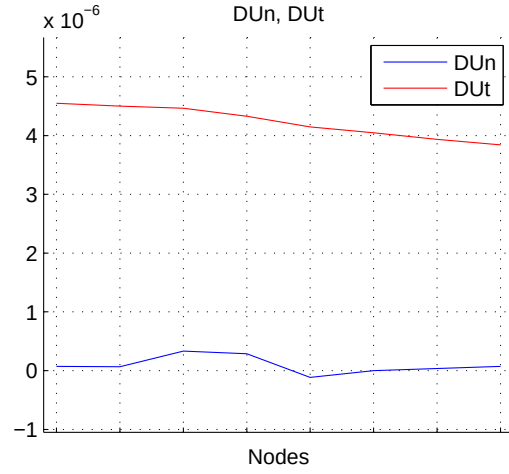


Figure 14: Model I - The normal and tangential components of displacement on the contact boundary 9-10

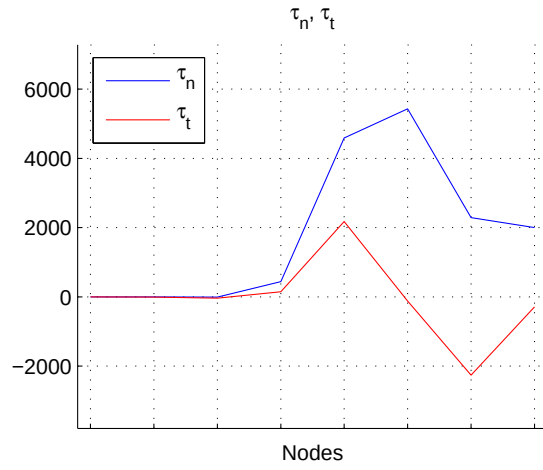


Figure 15: Model I - The normal and tangential components of stress vector on the contact boundary 9-10

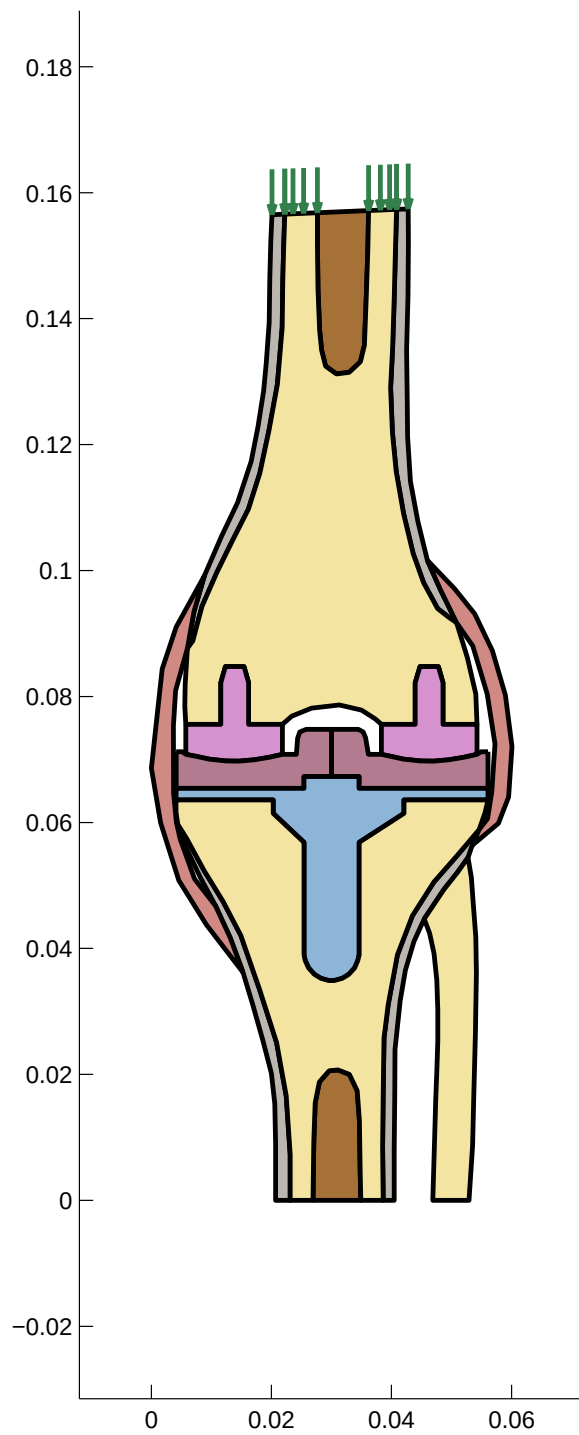


Figure 16: The geometry of the Model II

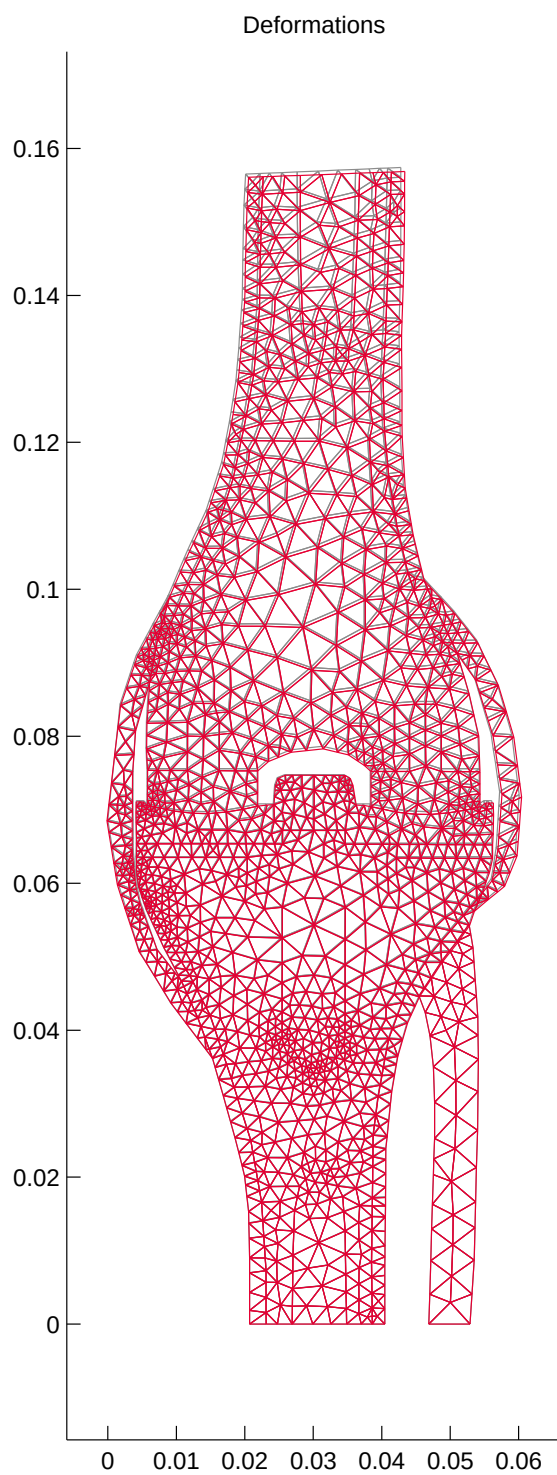


Figure 17: Model II - Deformations (enlarge factor=20)

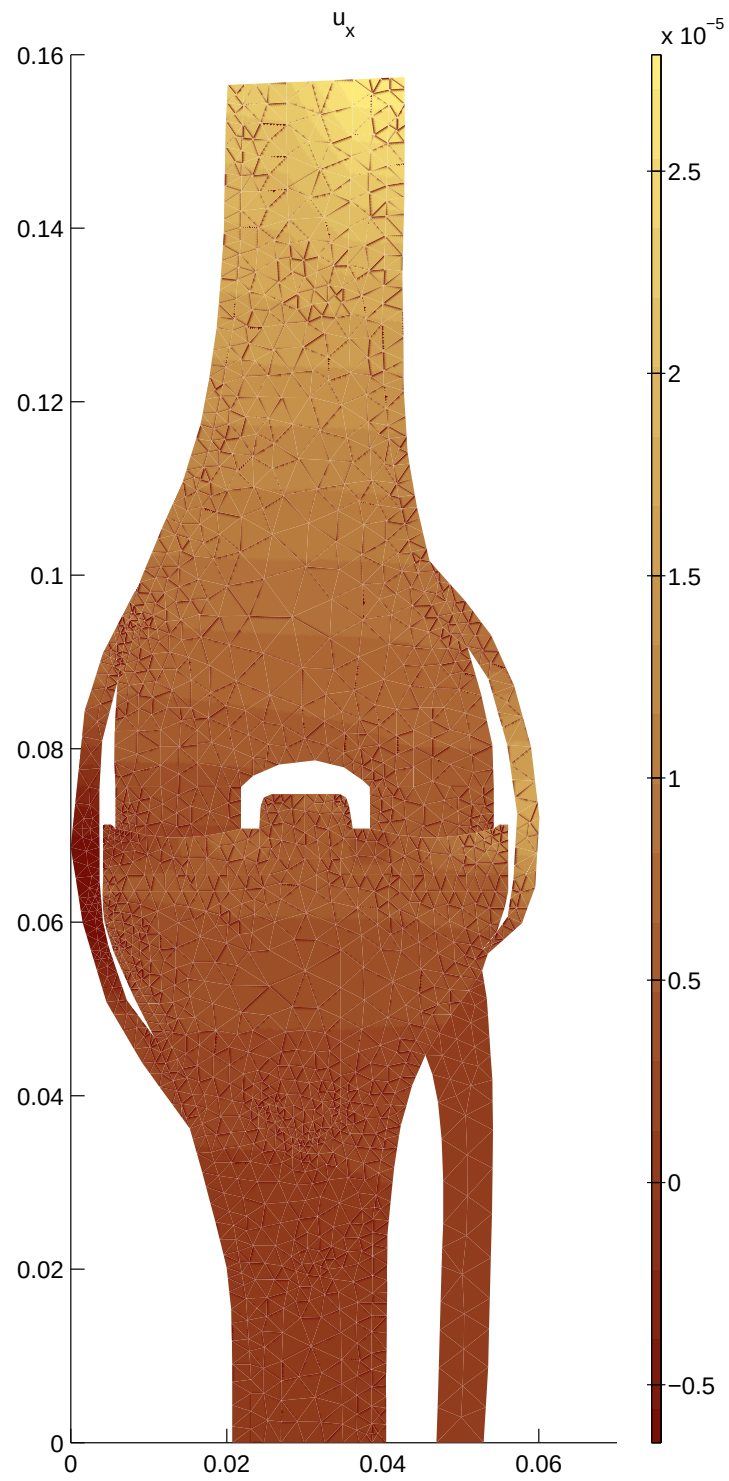


Figure 18: Model II - Horizontal component of displacement

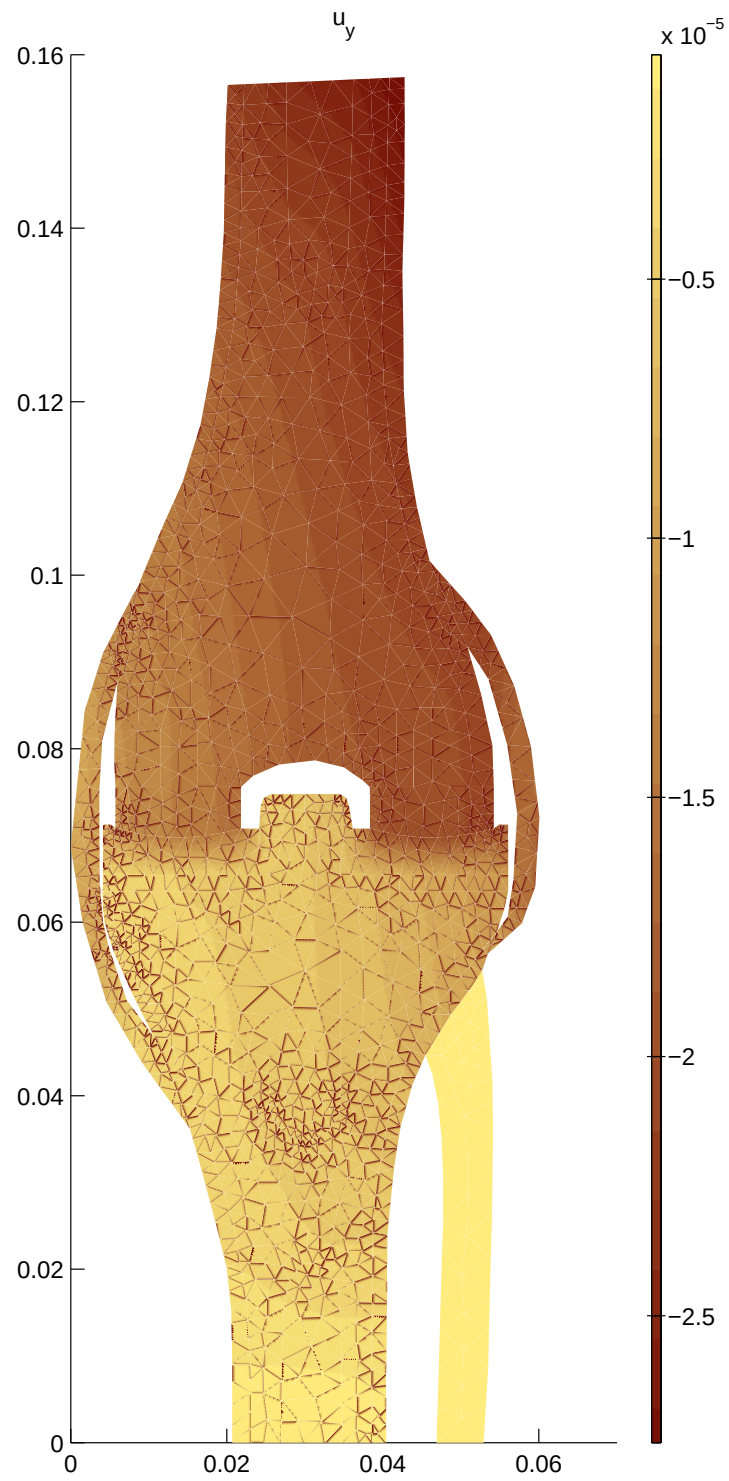


Figure 19: Model II - Vertical component of displacement

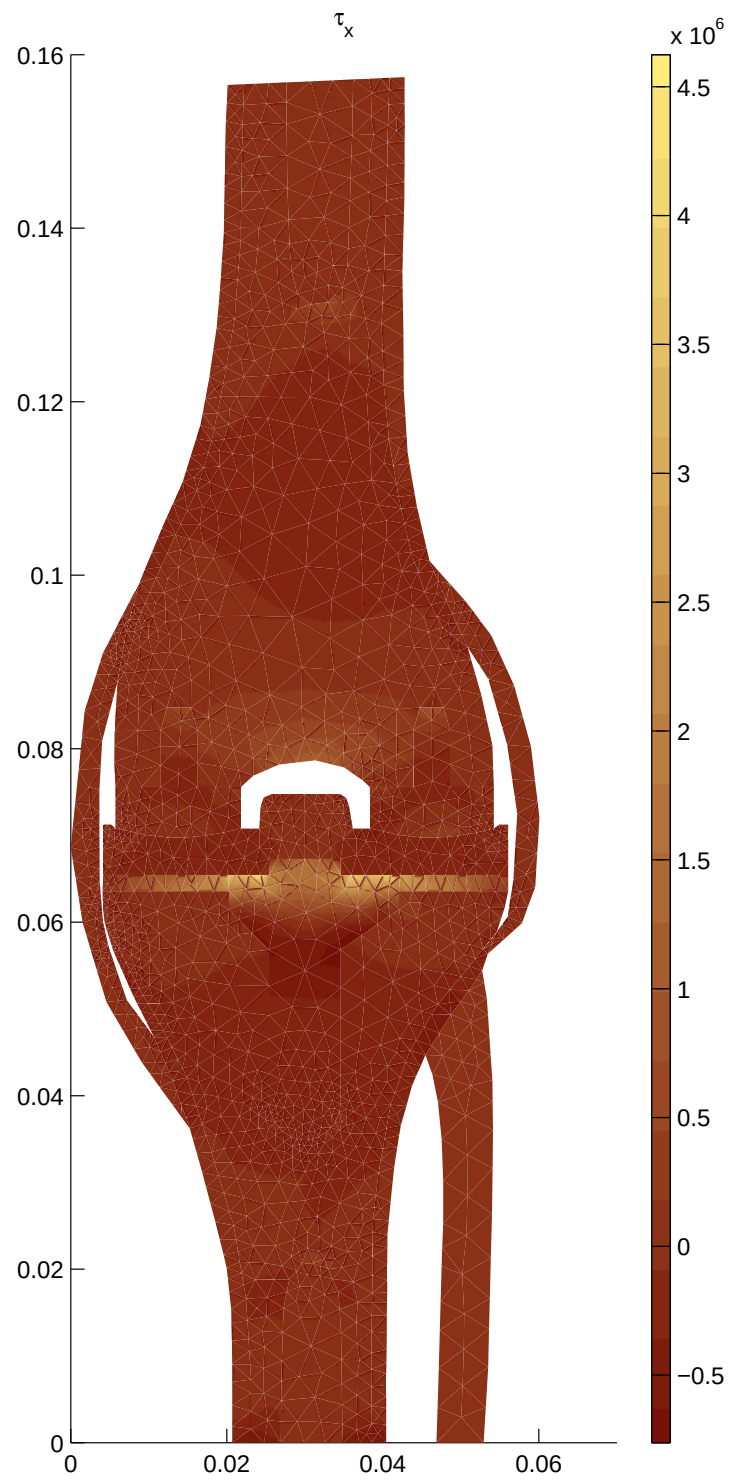


Figure 20: Model II - Stresses τ_x

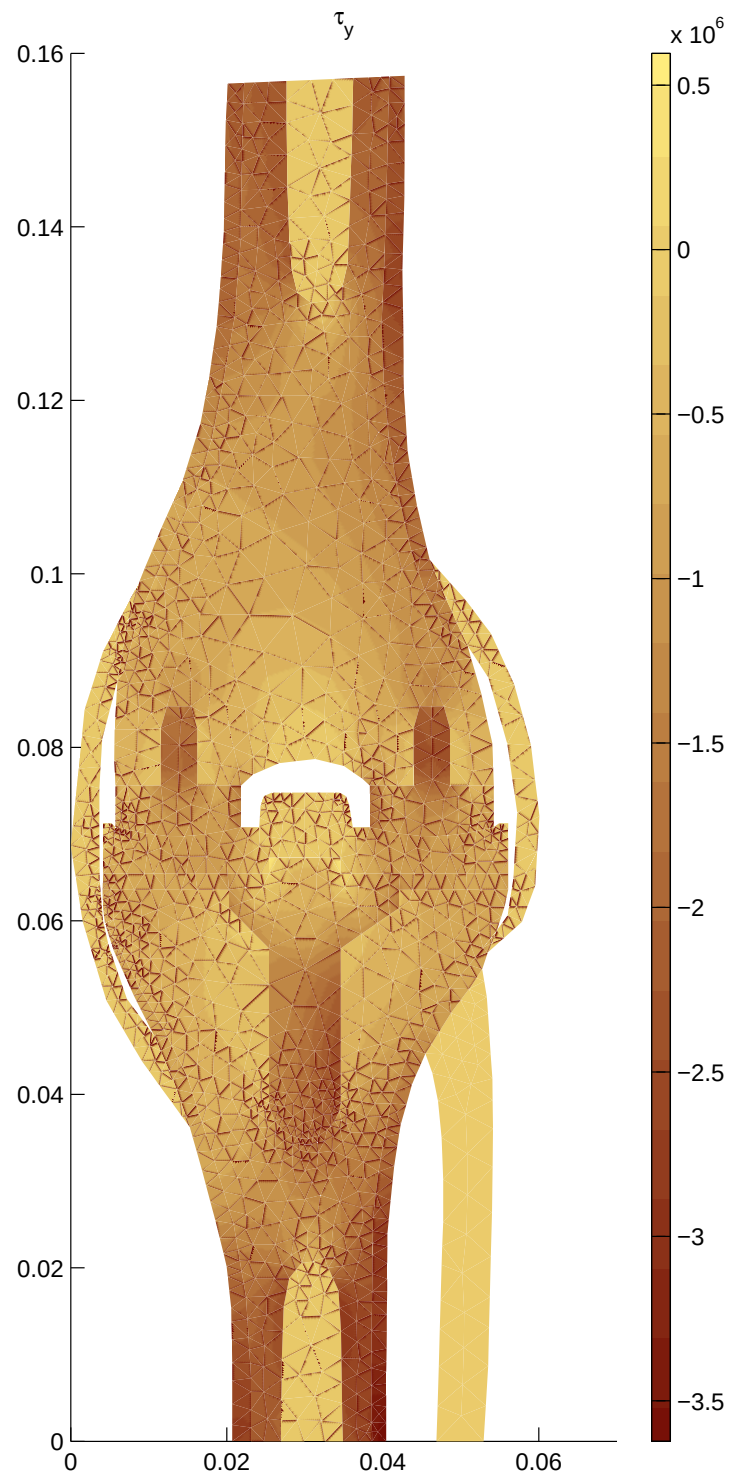


Figure 21: Model II - Stresses τ_y

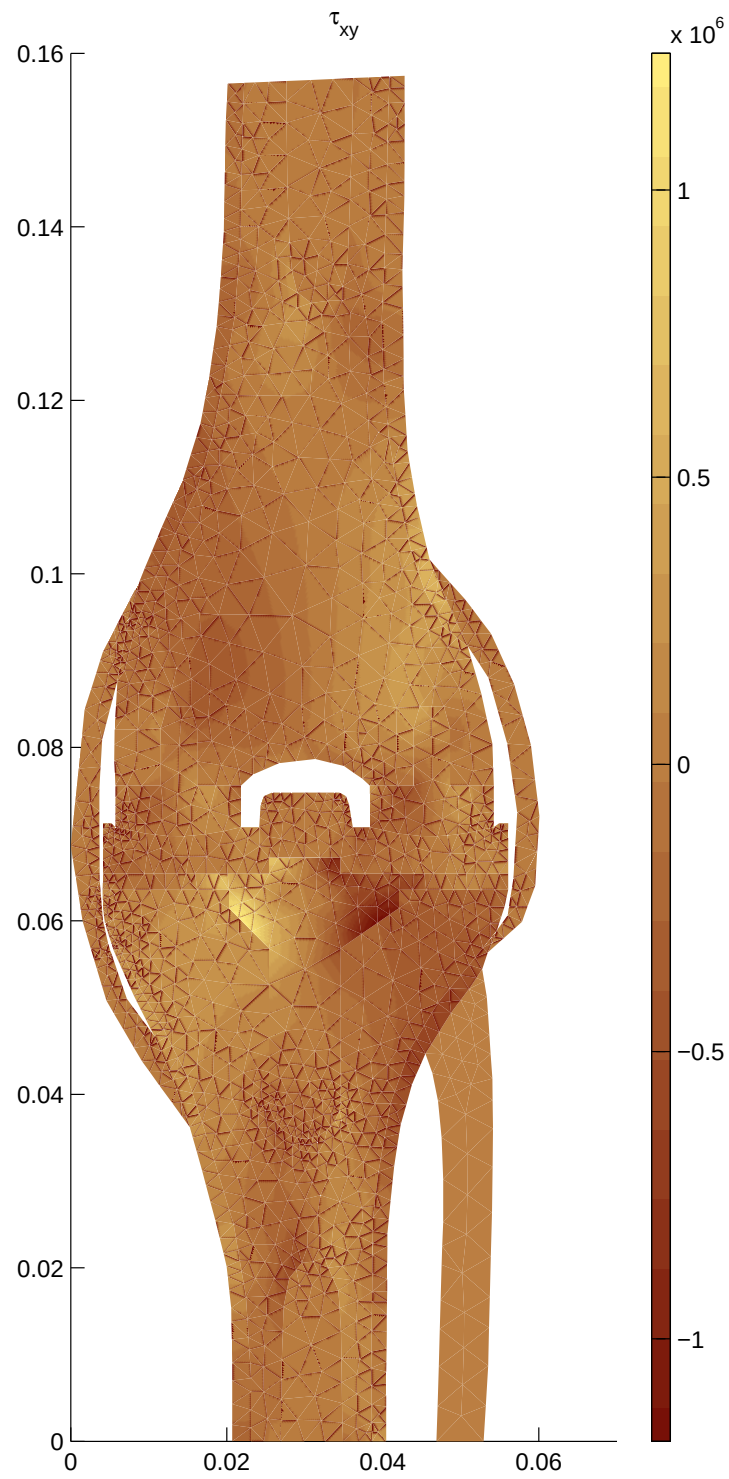


Figure 22: Model II - Stresses τ_{xy}

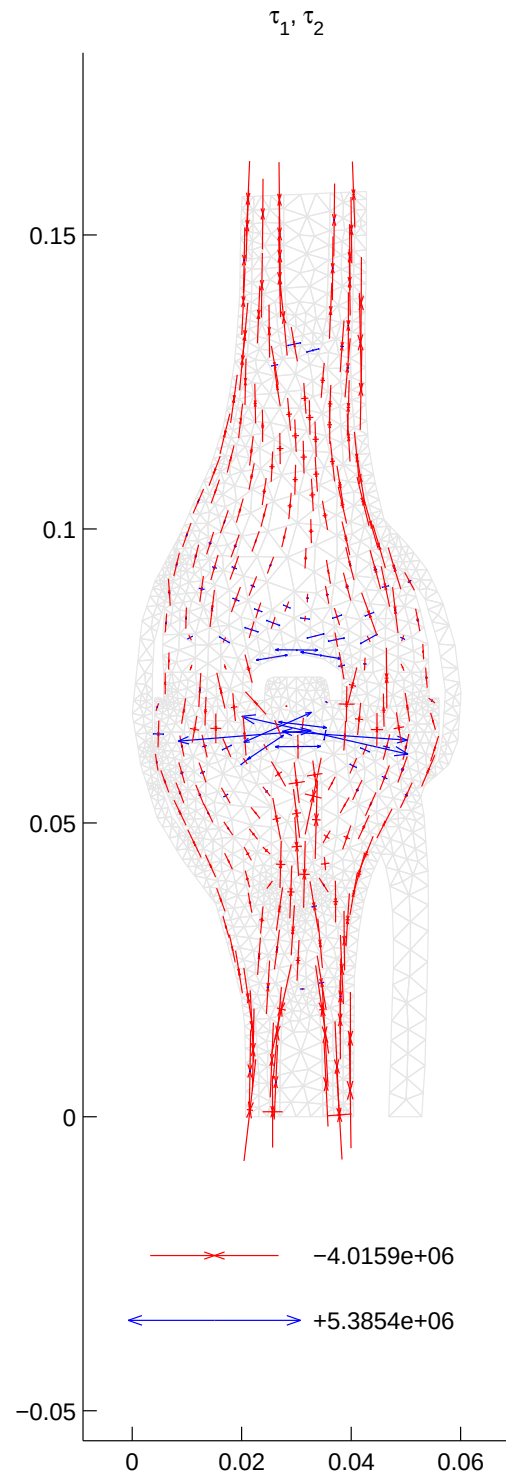


Figure 23: Model II - Principal stresses

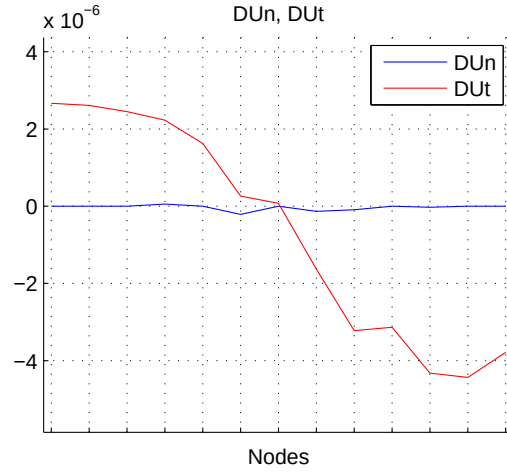


Figure 24: Model II - The normal and tangential components of displacement on the contact boundary 5-6

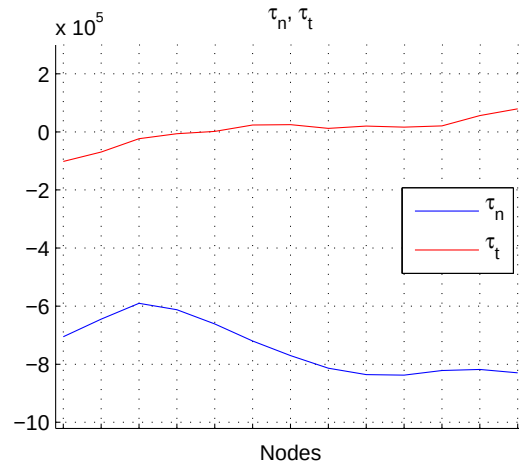


Figure 25: Model II - The normal and tangential components of stress vector on the contact boundary 5-6

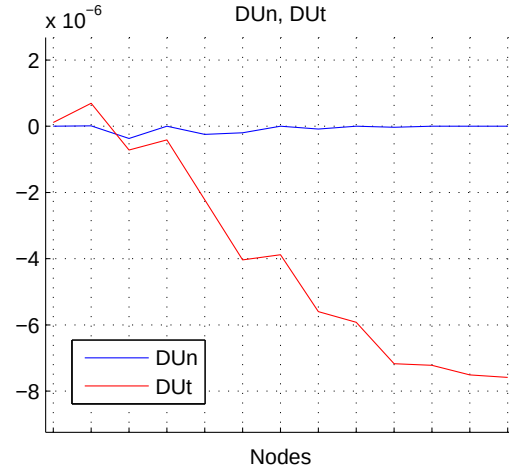


Figure 26: Model II - The normal and tangential components of displacement on the contact boundary 7-8

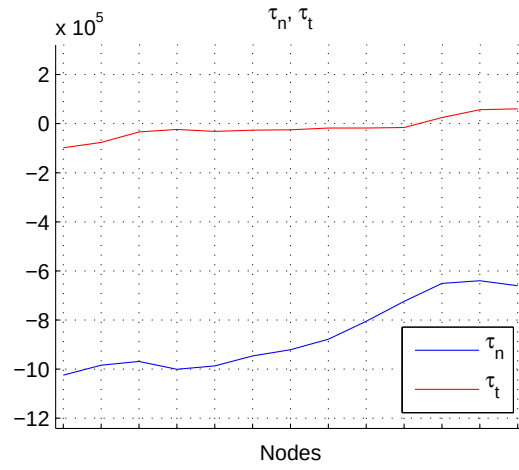


Figure 27: Model II - The normal and tangential components of stress vector on the contact boundary 7-8

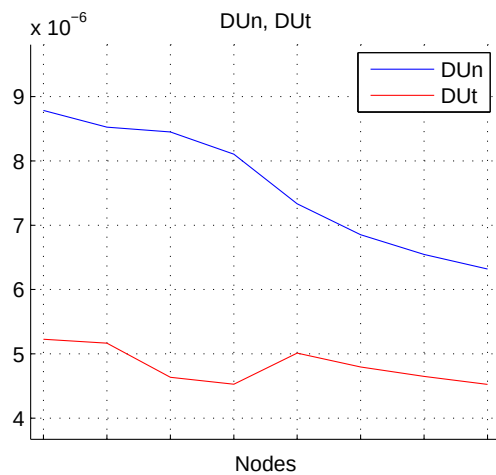


Figure 28: Model II - The normal and tangential components of displacement on the contact boundary 9-10

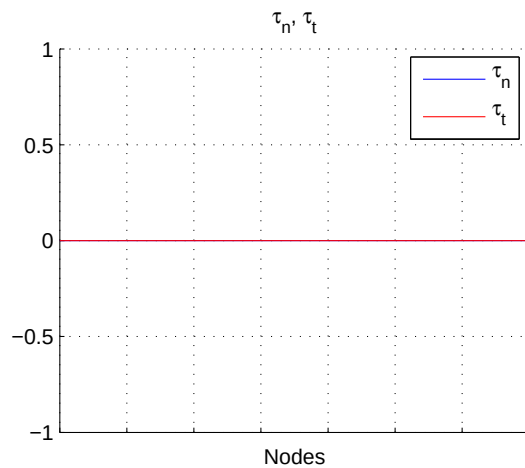


Figure 29: Model II - The normal and tangential components of stress vector on the contact boundary 9-10

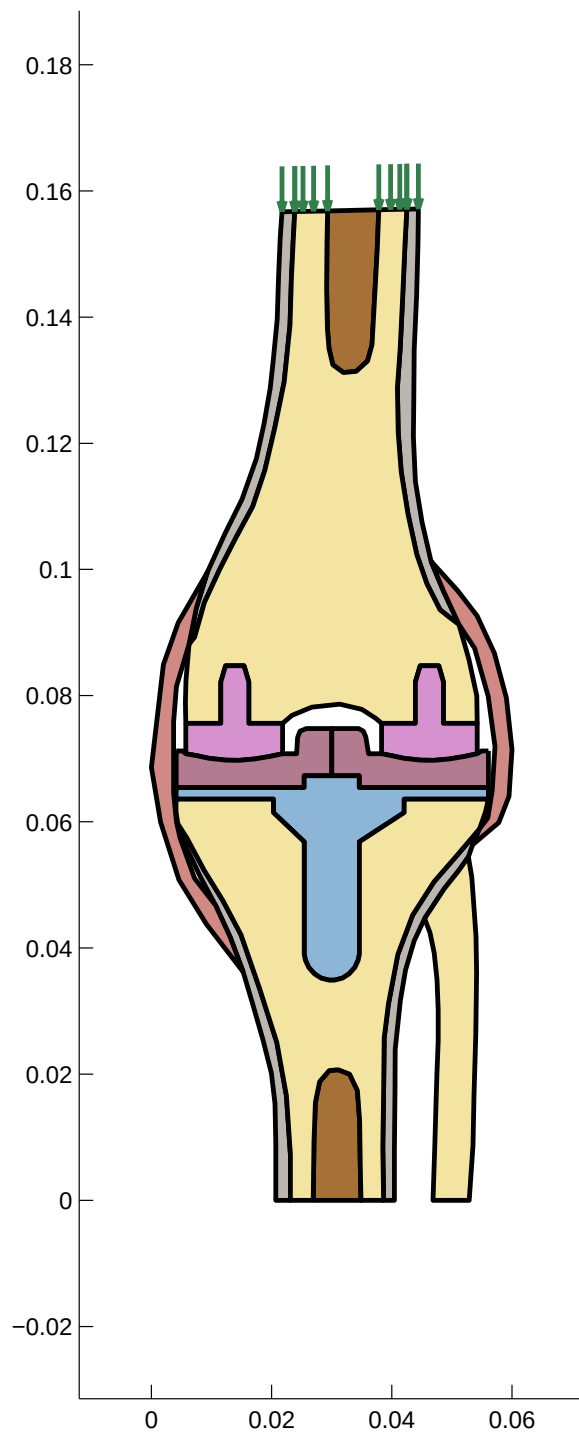


Figure 30: The geometry of the Model III

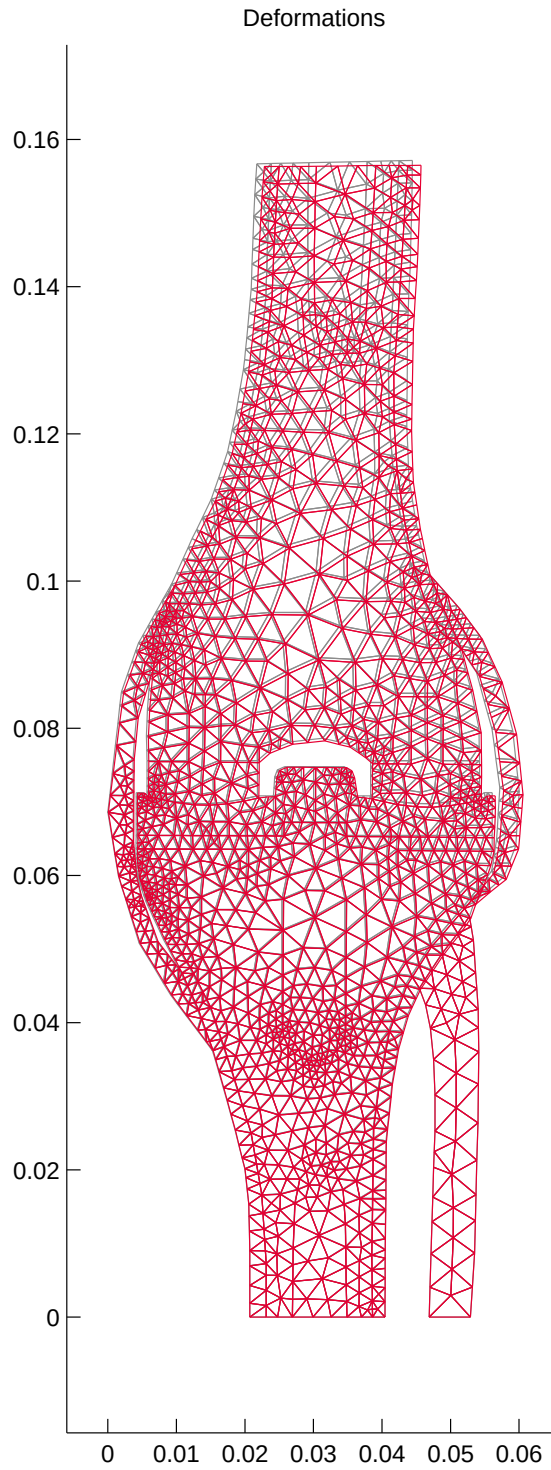


Figure 31: Model III - Deformations (enlarge factor=20)

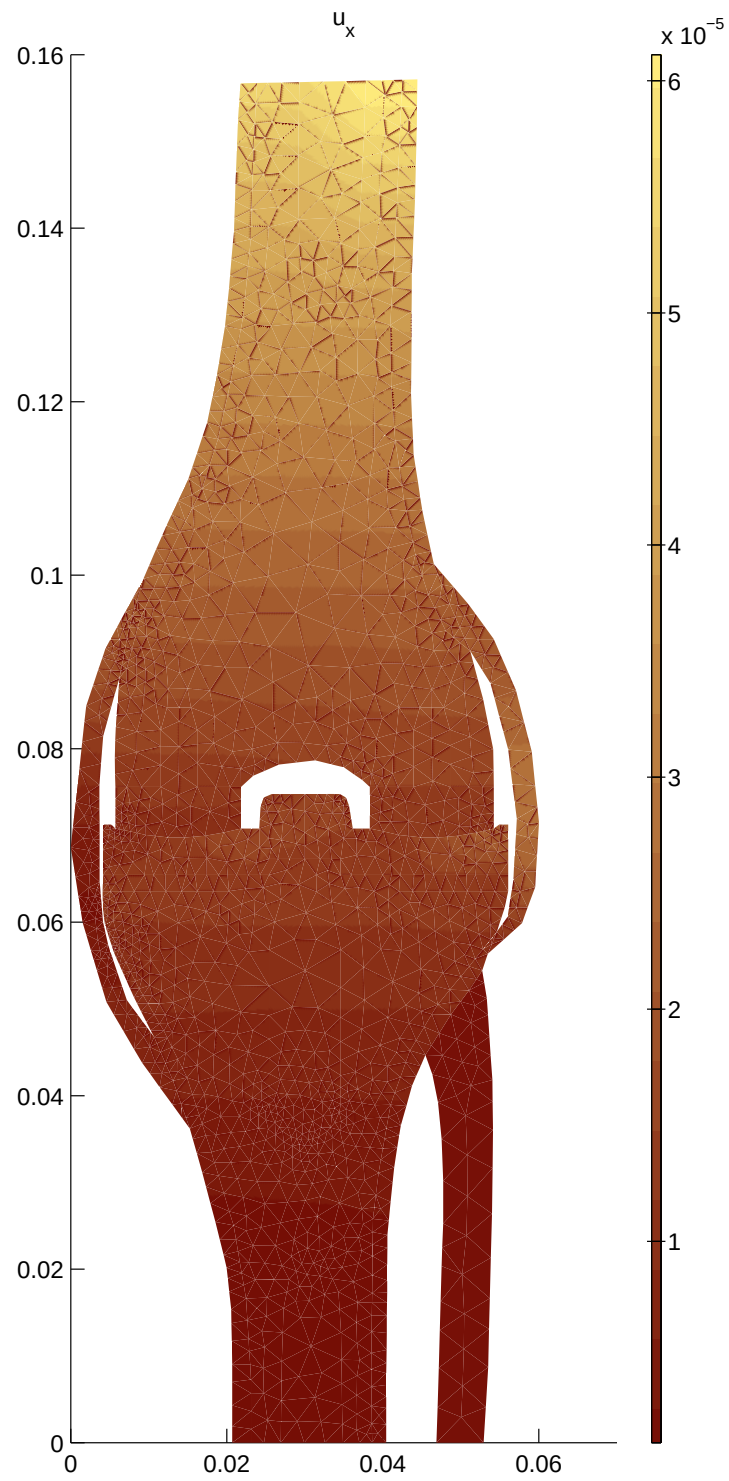


Figure 32: Model III - Horizontal component of displacement

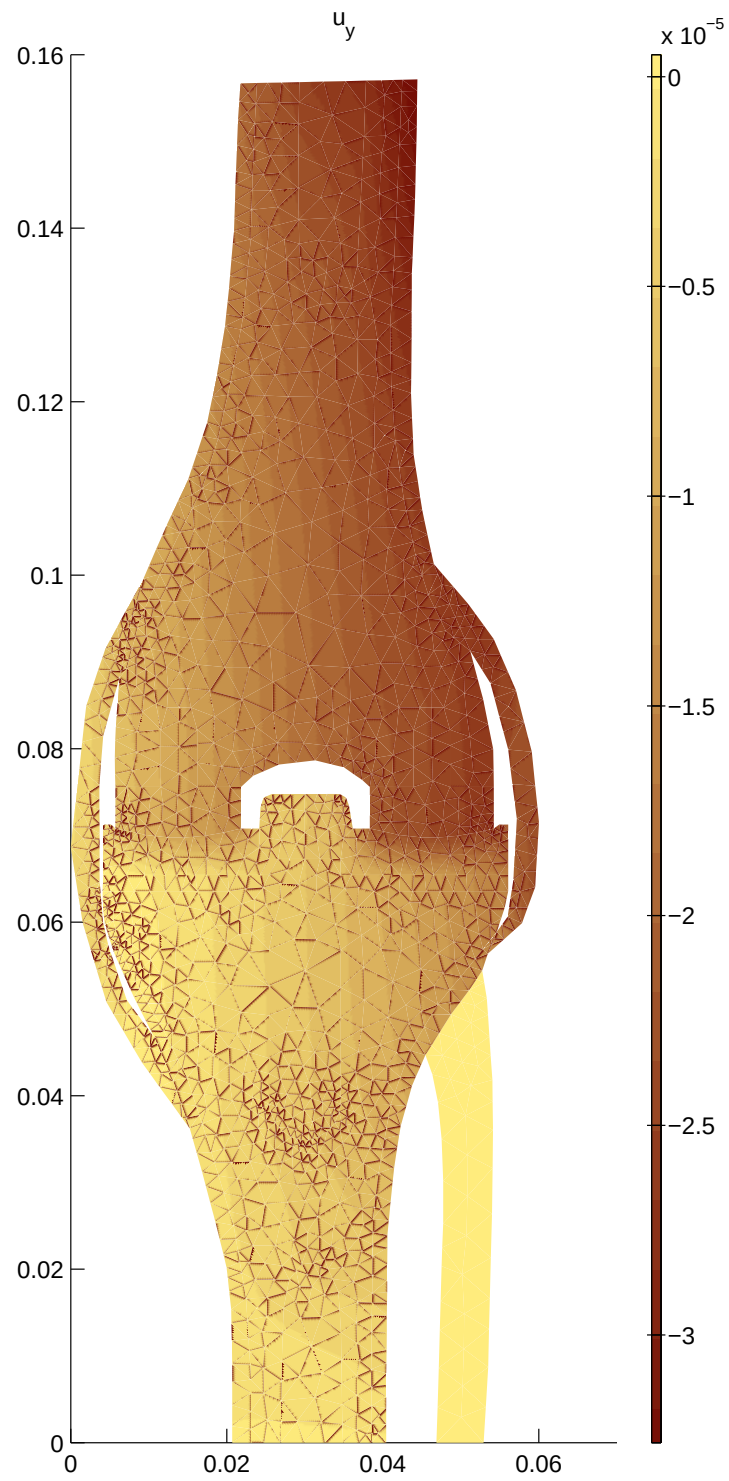


Figure 33: Model III - Vertical component of displacement

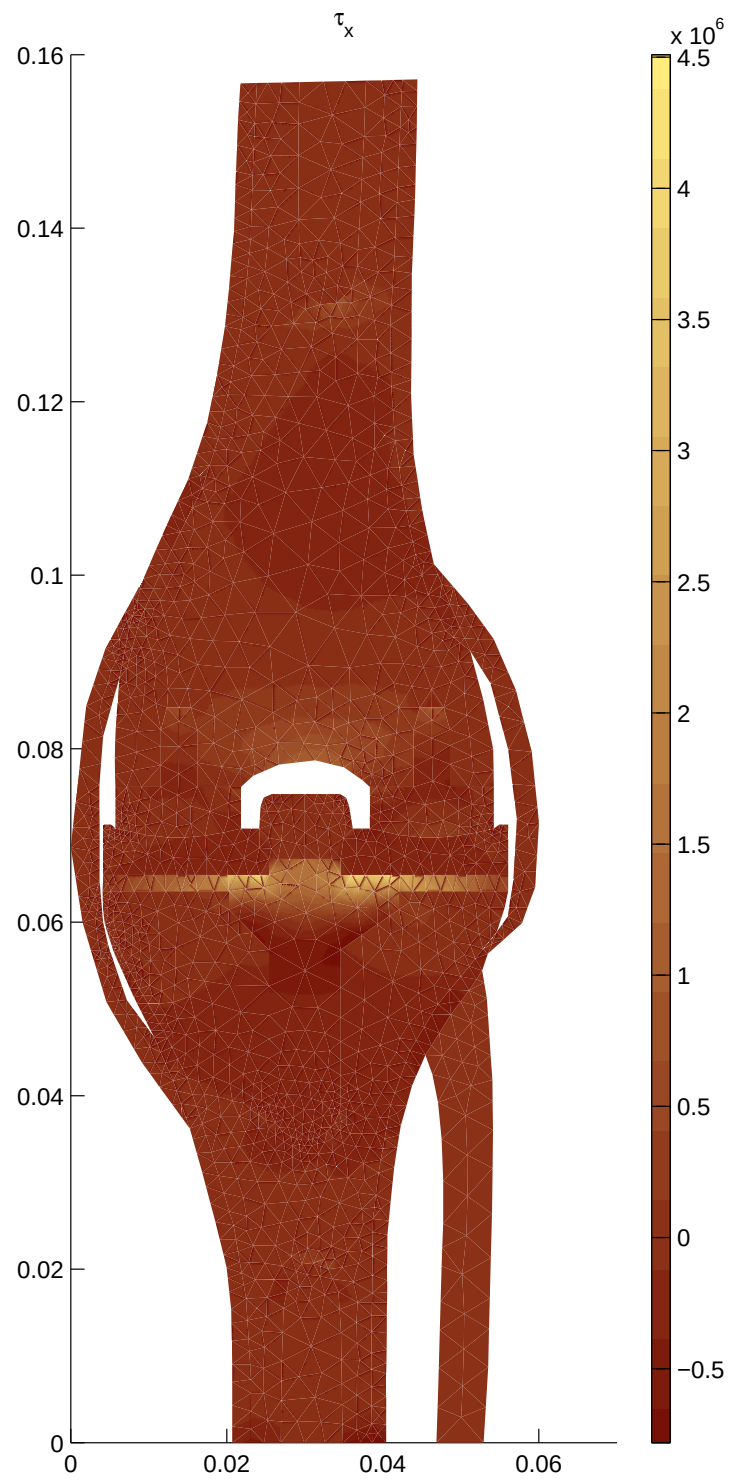


Figure 34: Model III - Stresses τ_x

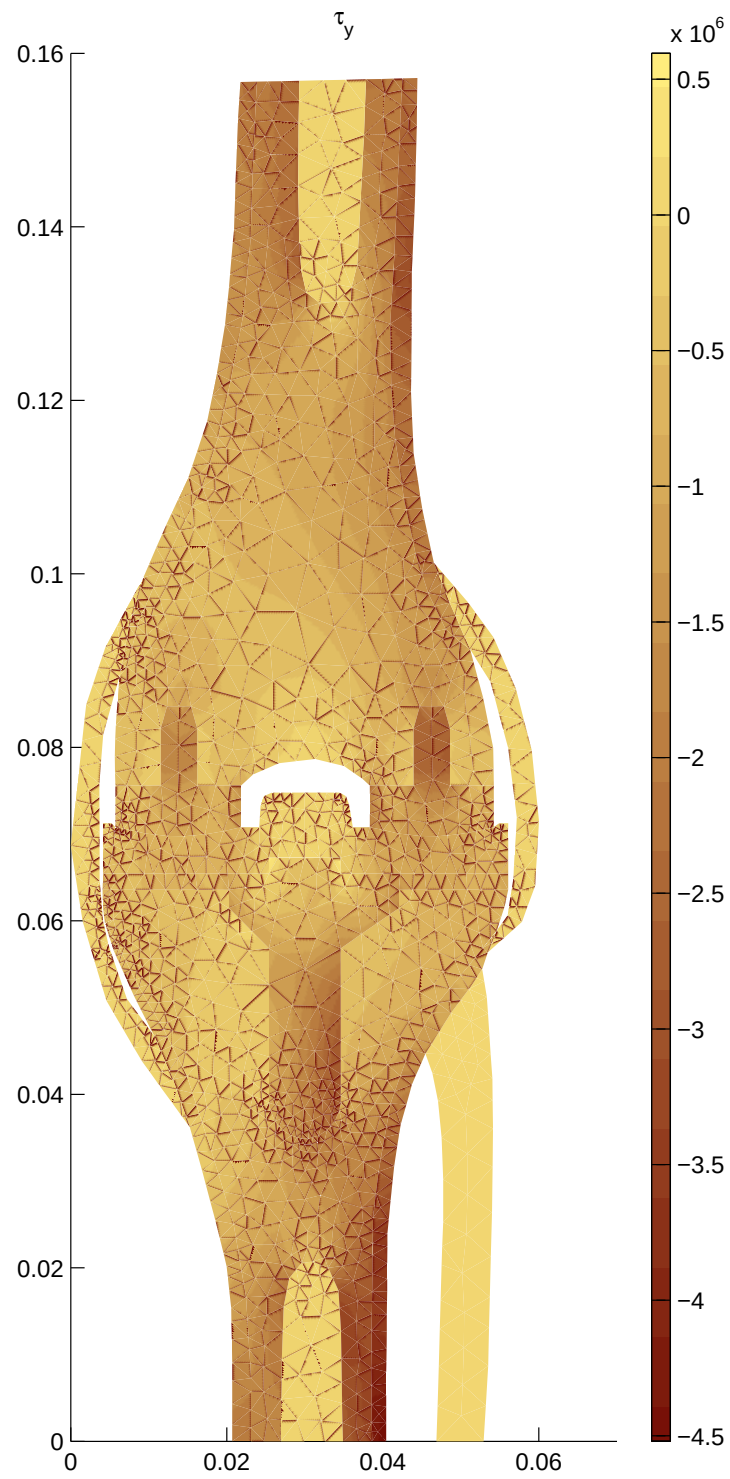


Figure 35: Model III - Stresses τ_y

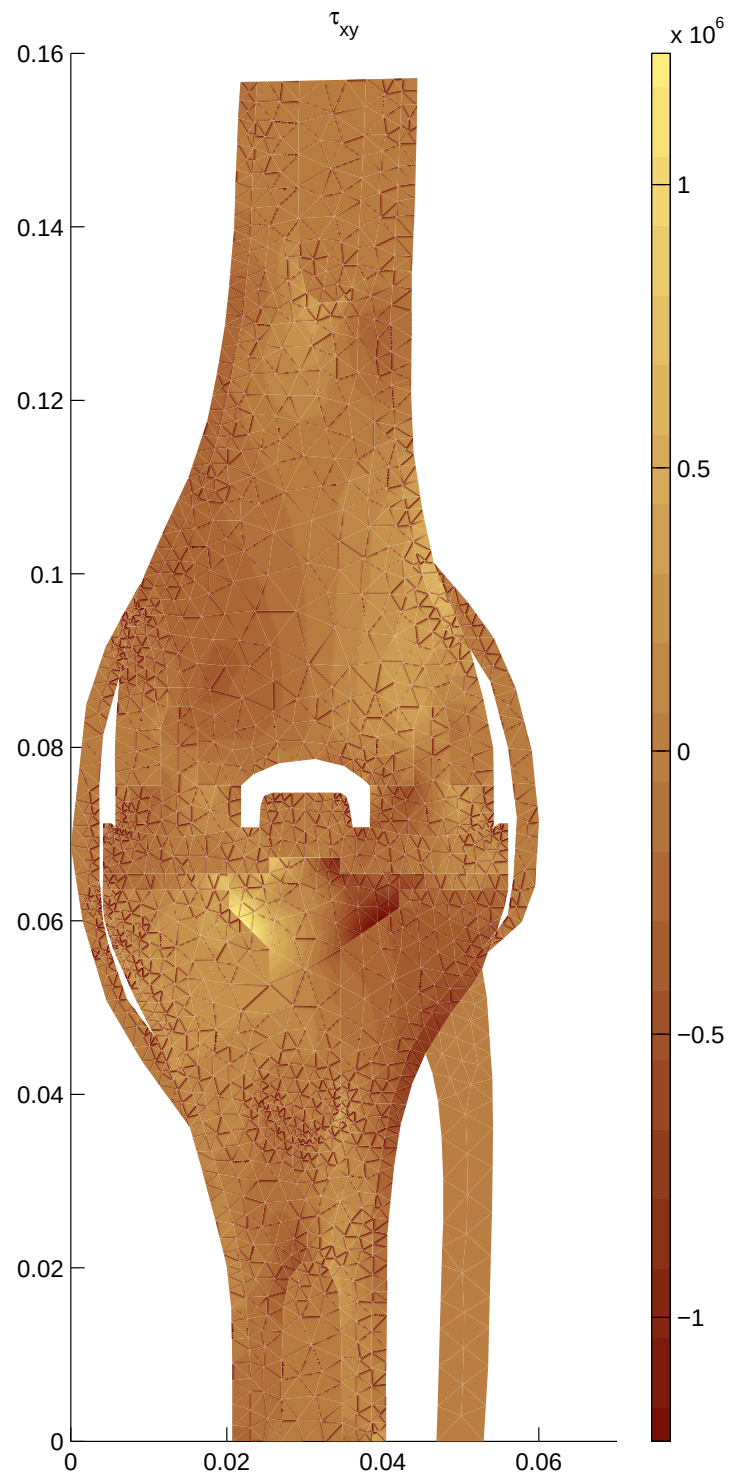


Figure 36: Model III - Stresses τ_{xy}

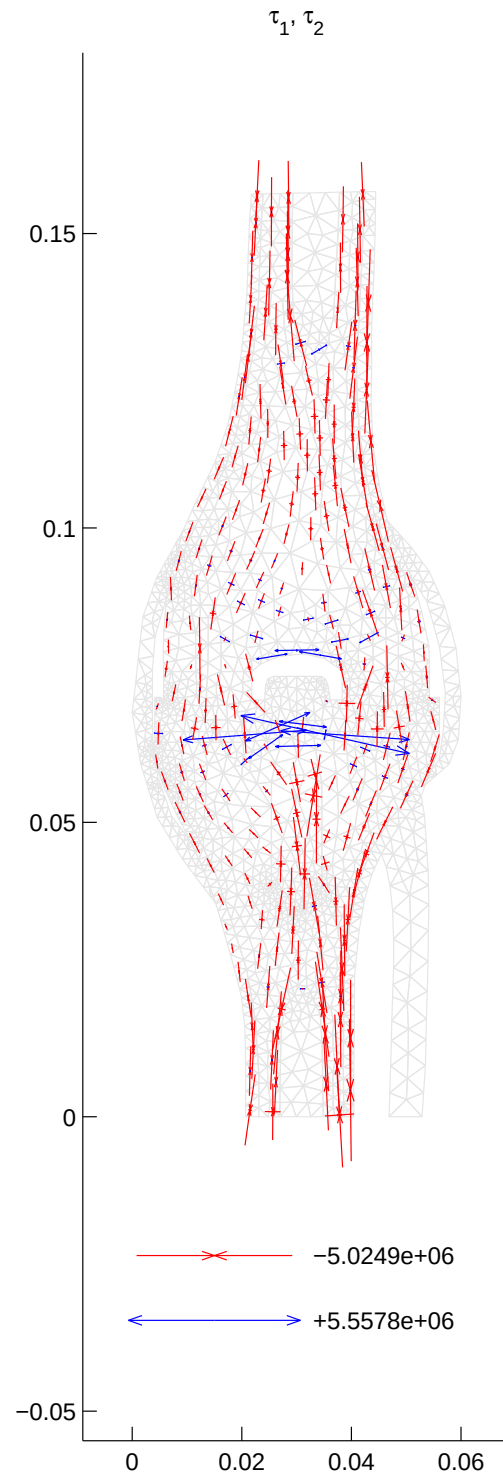


Figure 37: Model III - Principal stresses

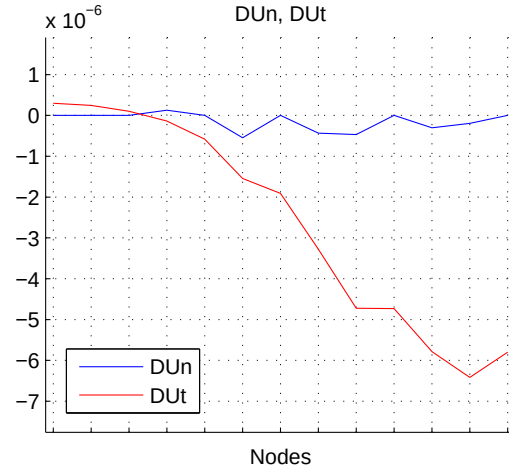


Figure 38: Model III - The normal and tangential components of displacement on the contact boundary 5-6

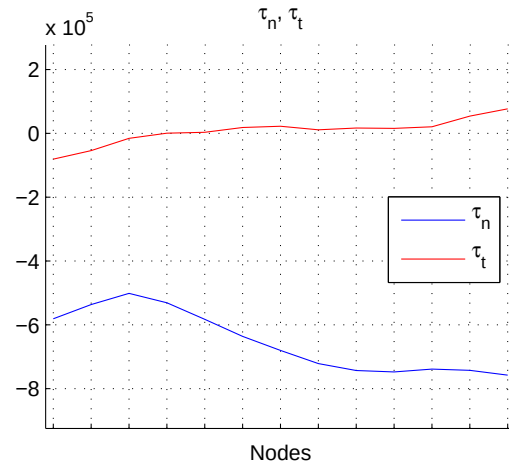


Figure 39: Model III - The normal and tangential components of stress vector on the contact boundary 5-6

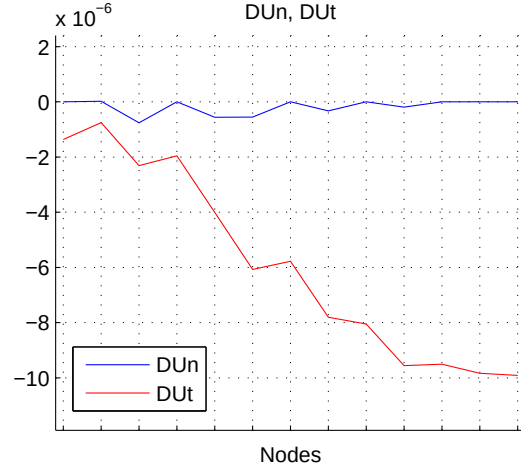


Figure 40: Model III - The normal and tangential components of displacement on the contact boundary 7-8

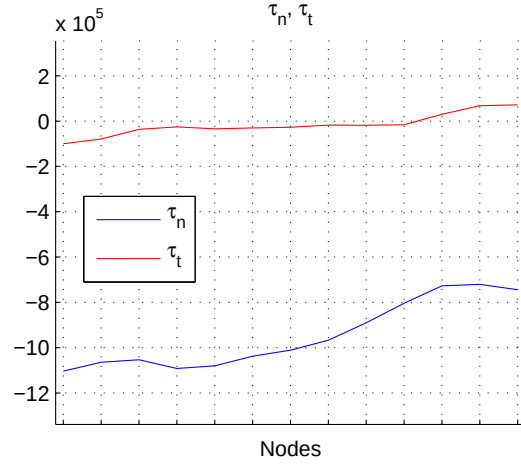


Figure 41: Model III - The normal and tangential components of stress vector on the contact boundary 7-8

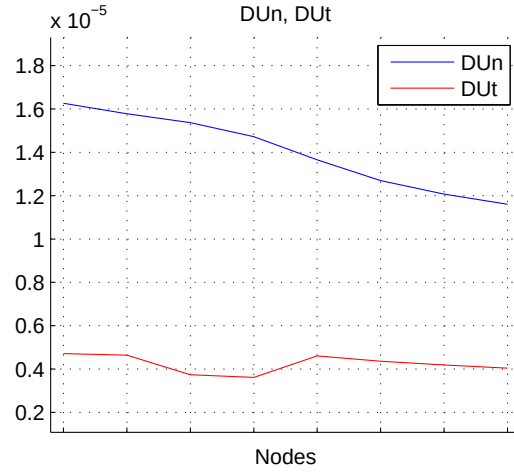


Figure 42: Model III - The normal and tangential components of displacement on the contact boundary 9-10

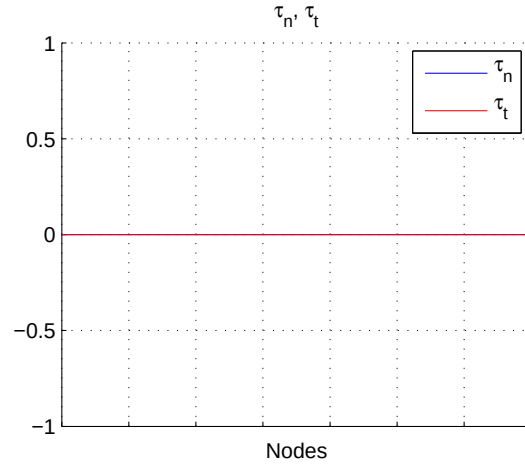


Figure 43: Model III - The normal and tangential components of stress vector on the contact boundary 9-10

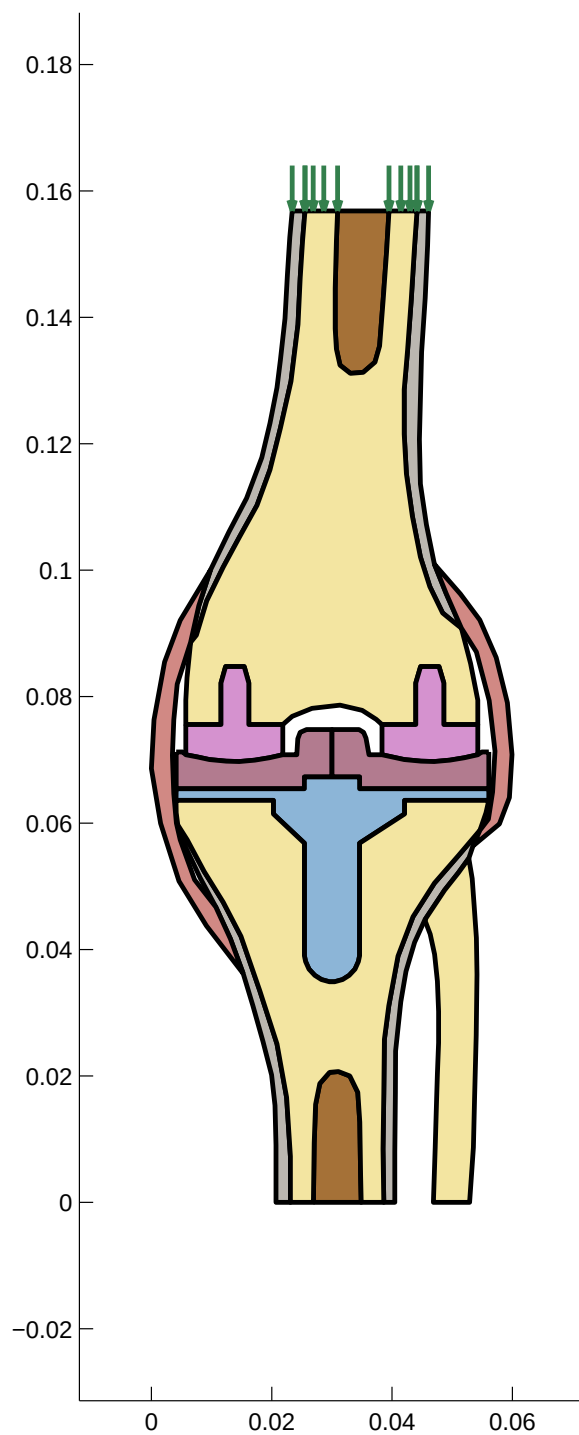


Figure 44: The geometry of the Model IV

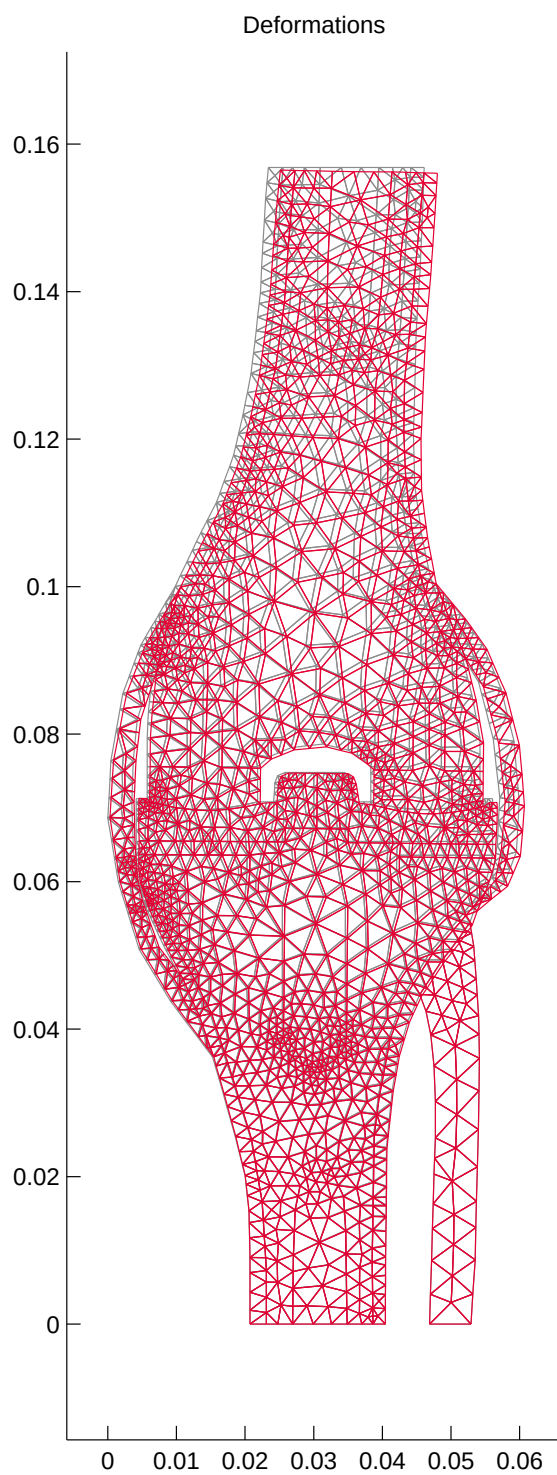


Figure 45: Model IV - Deformations (enlarge factor=20)

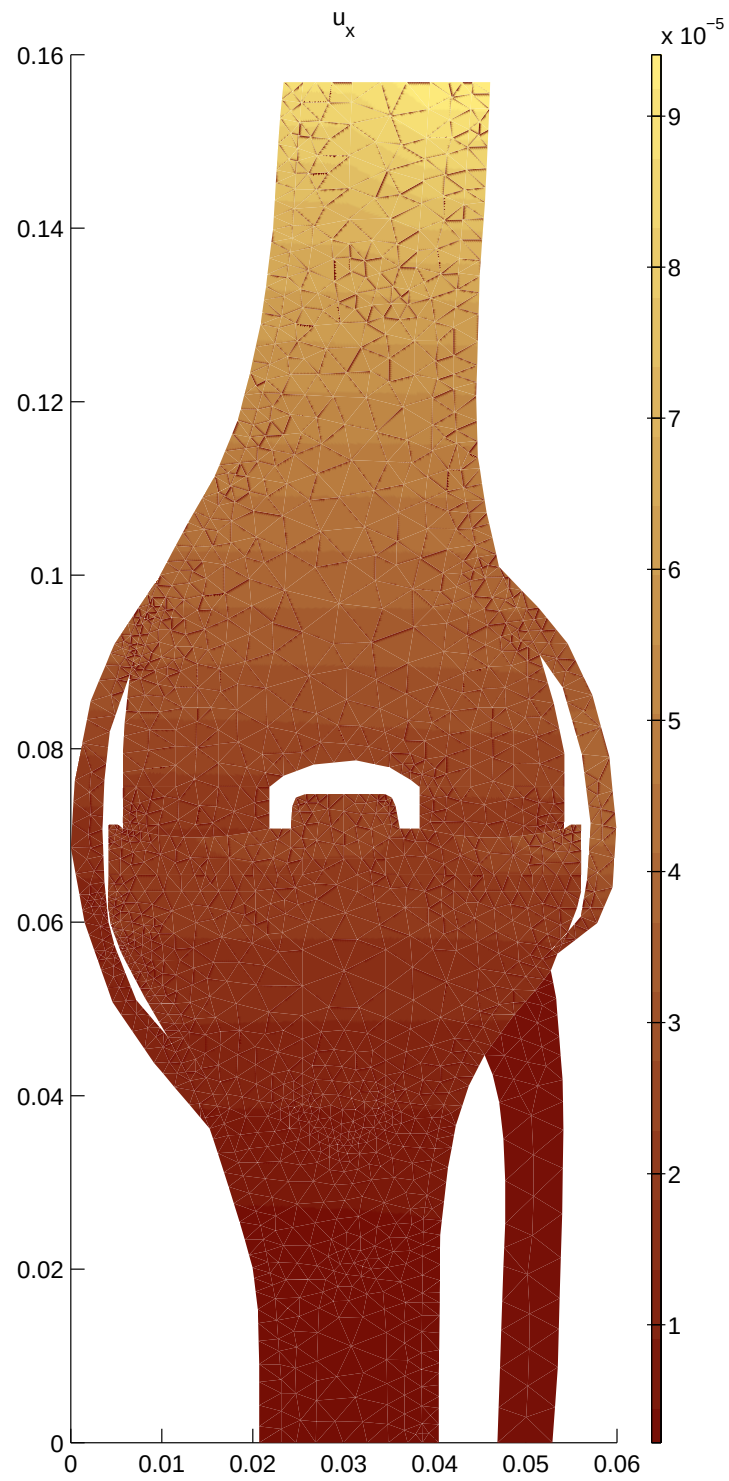


Figure 46: Model IV - Horizontal component of displacement

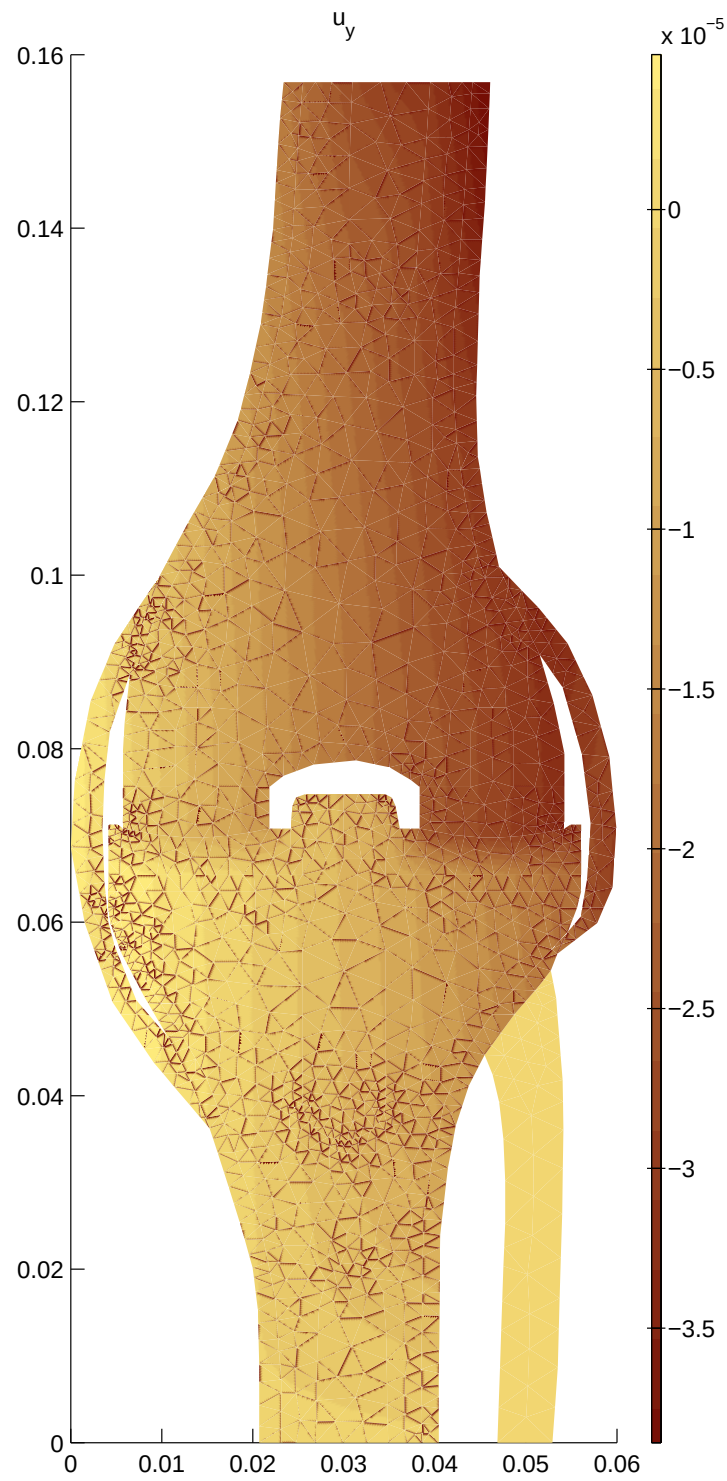


Figure 47: Model IV - Vertical component of displacement

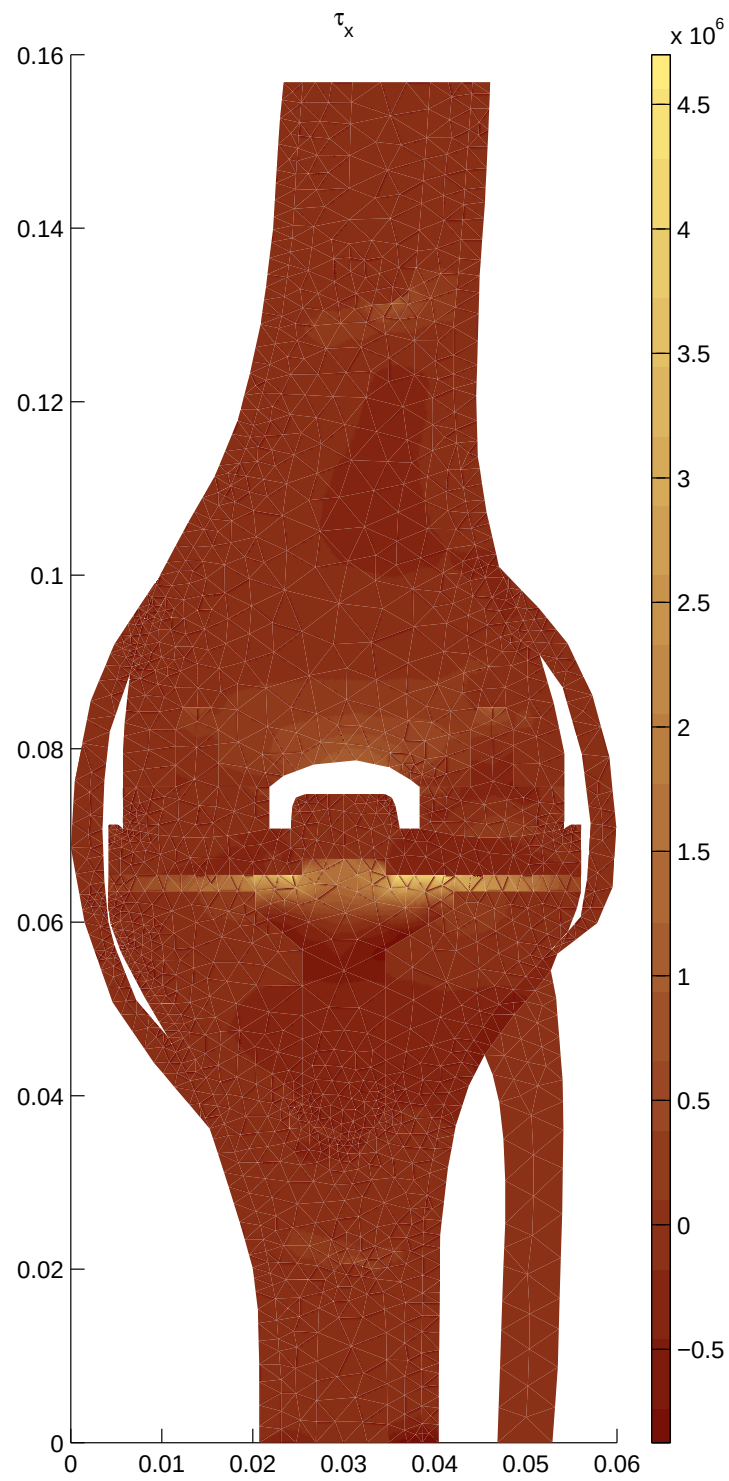


Figure 48: Model IV - Stresses τ_x

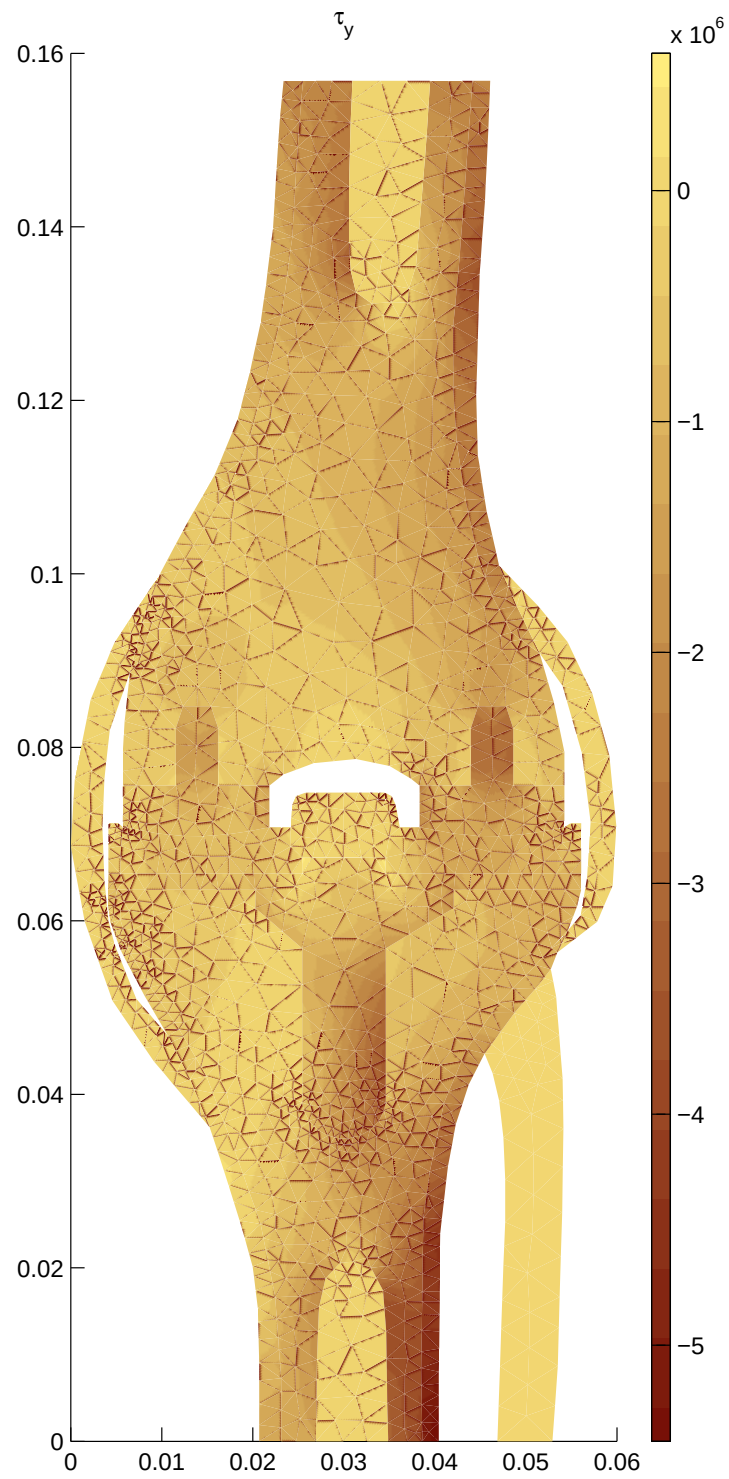


Figure 49: Model IV - Stresses τ_y

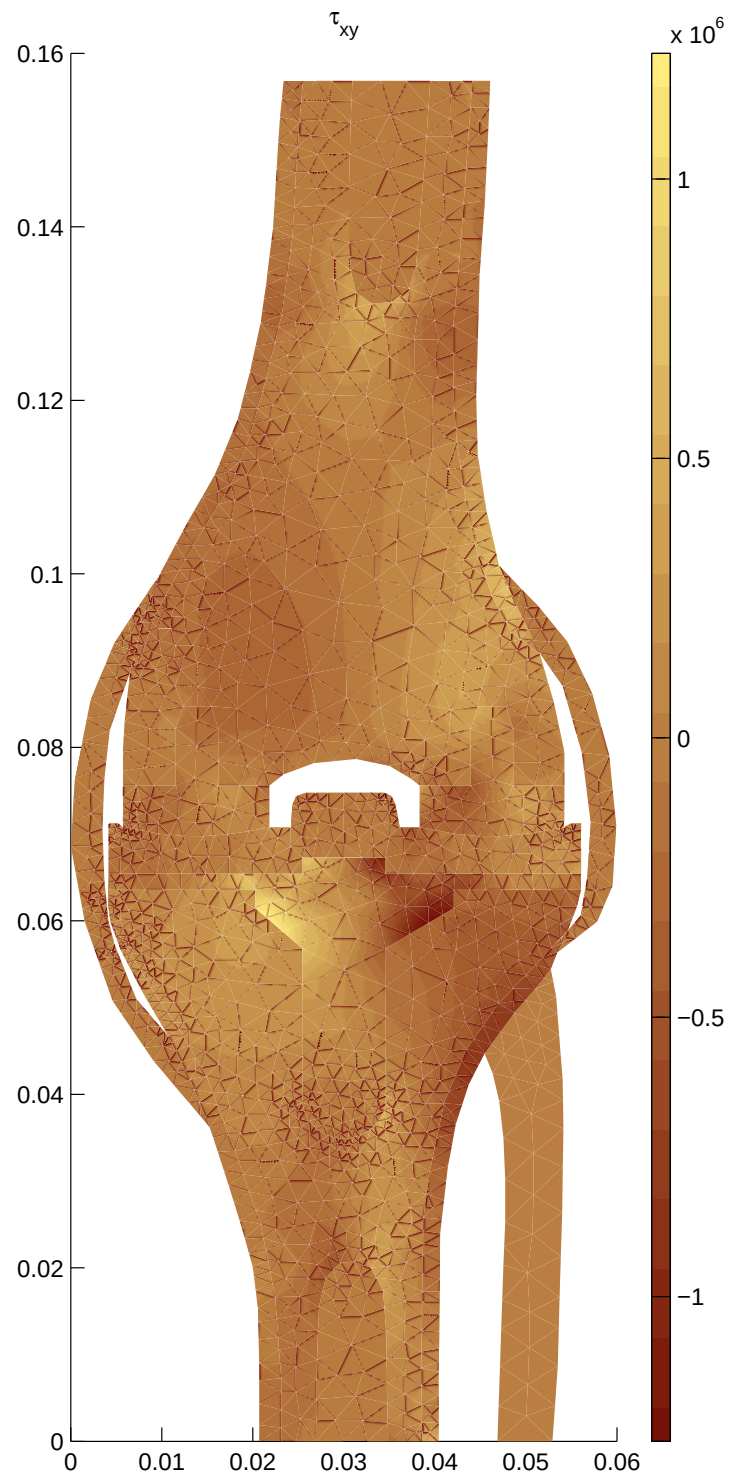


Figure 50: Model IV - Stresses τ_{xy}

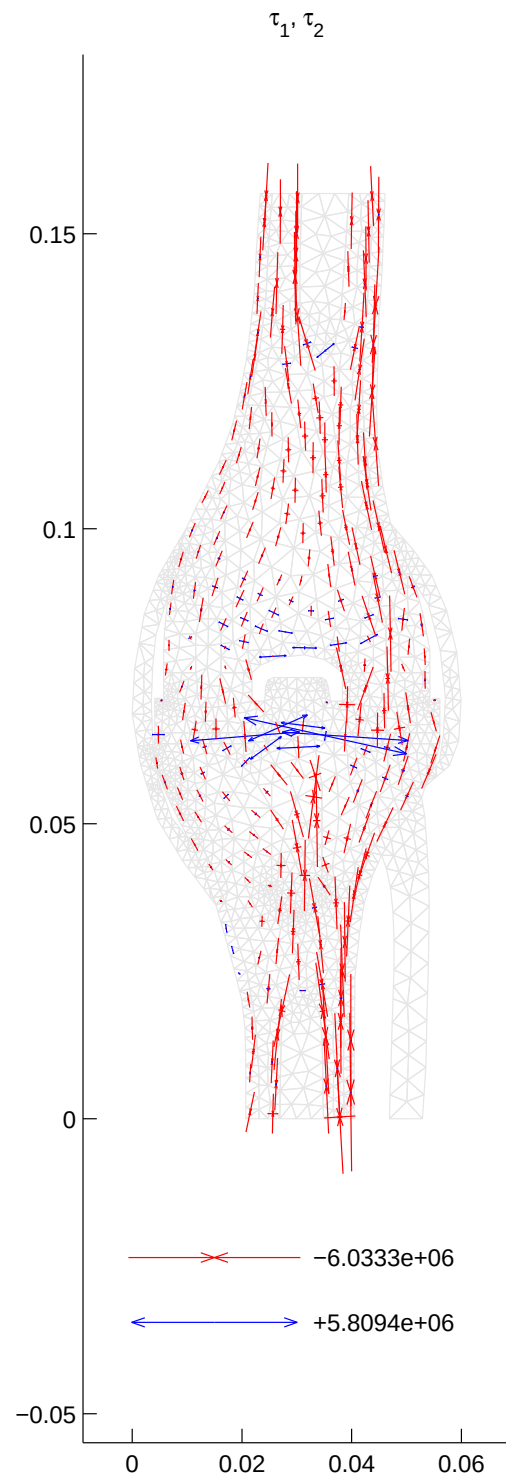


Figure 51: Model IV - Principal stresses

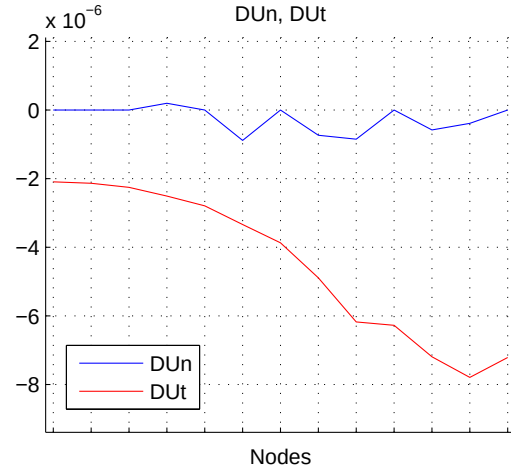


Figure 52: Model IV - The normal and tangential components of displacement on the contact boundary 5-6

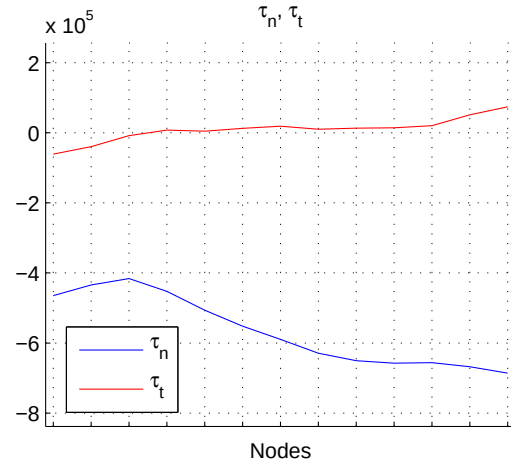


Figure 53: Model IV - The normal and tangential components of stress vector on the contact boundary 5-6

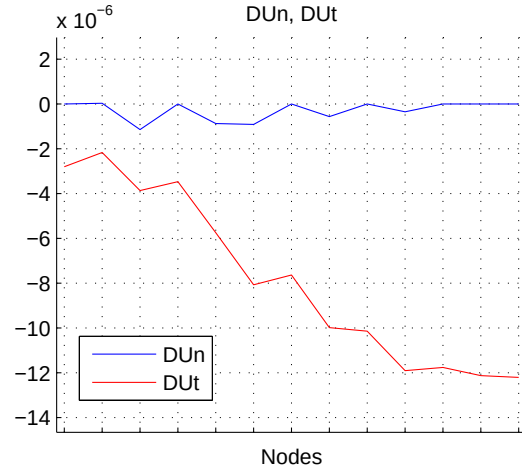


Figure 54: Model IV - The normal and tangential components of displacement on the contact boundary 7-8

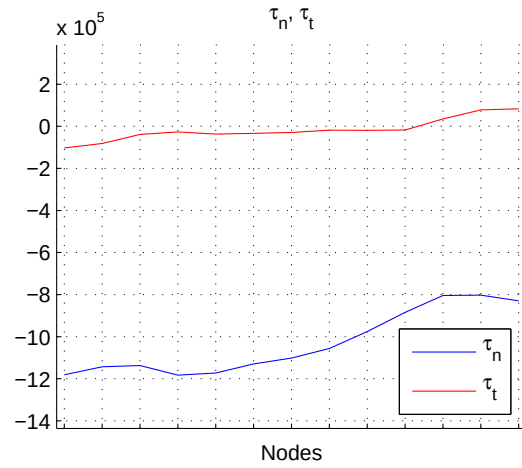


Figure 55: Model IV - The normal and tangential components of stress vector on the contact boundary 7-8

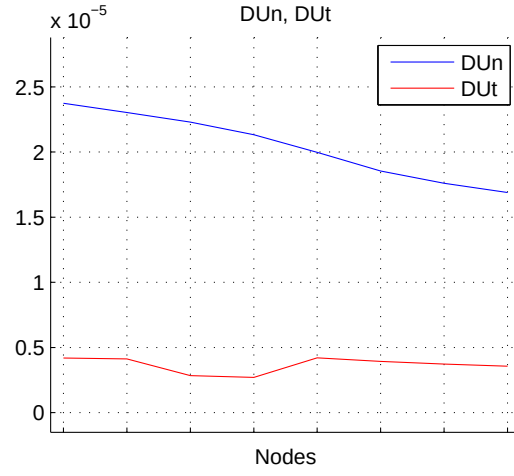


Figure 56: Model IV - The normal and tangential components of displacement on the contact boundary 9-10

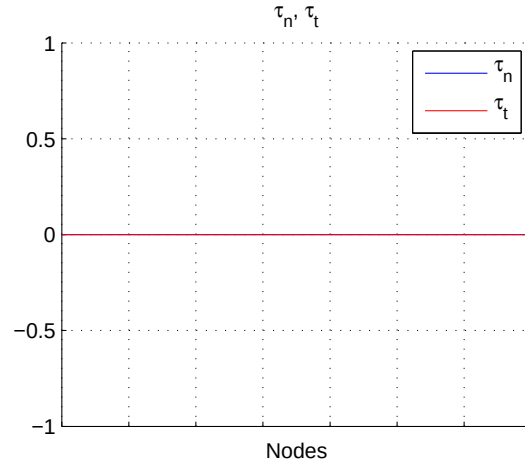


Figure 57: Model IV - The normal and tangential components of stress vector on the contact boundary 9-10

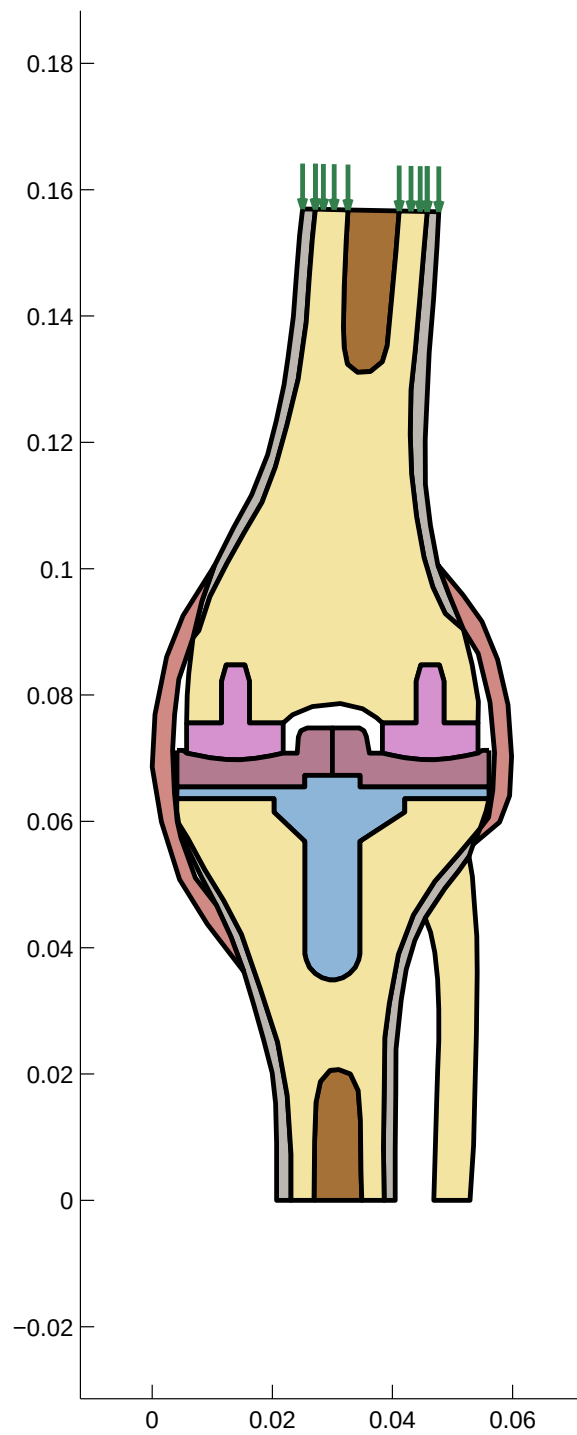


Figure 58: The geometry of the Model V

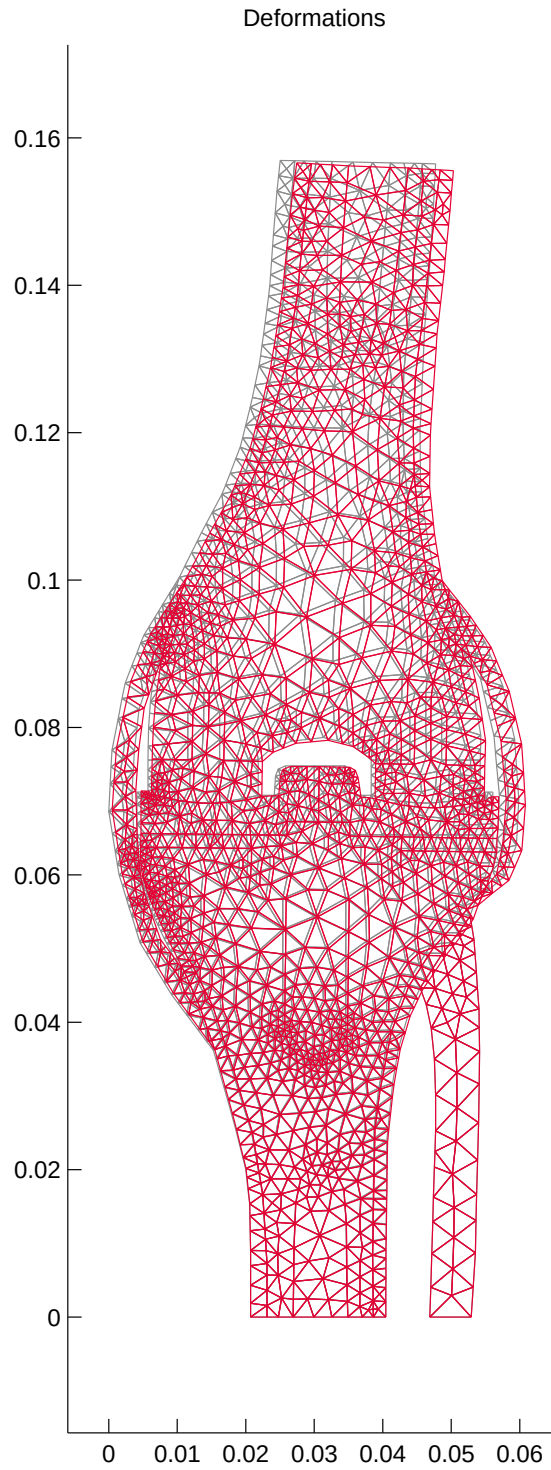


Figure 59: Model V - Deformations (enlarge factor=20)

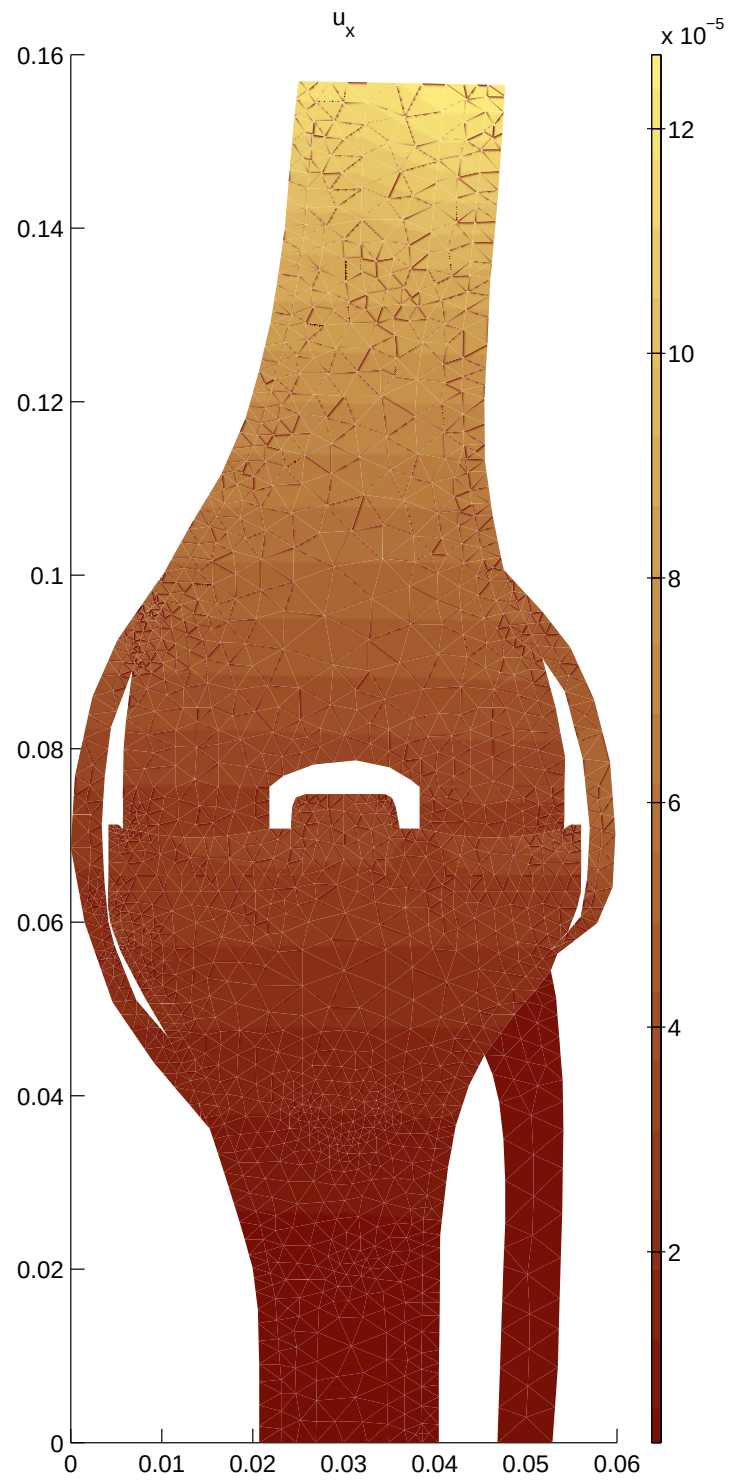


Figure 60: Model V - Horizontal component of displacement

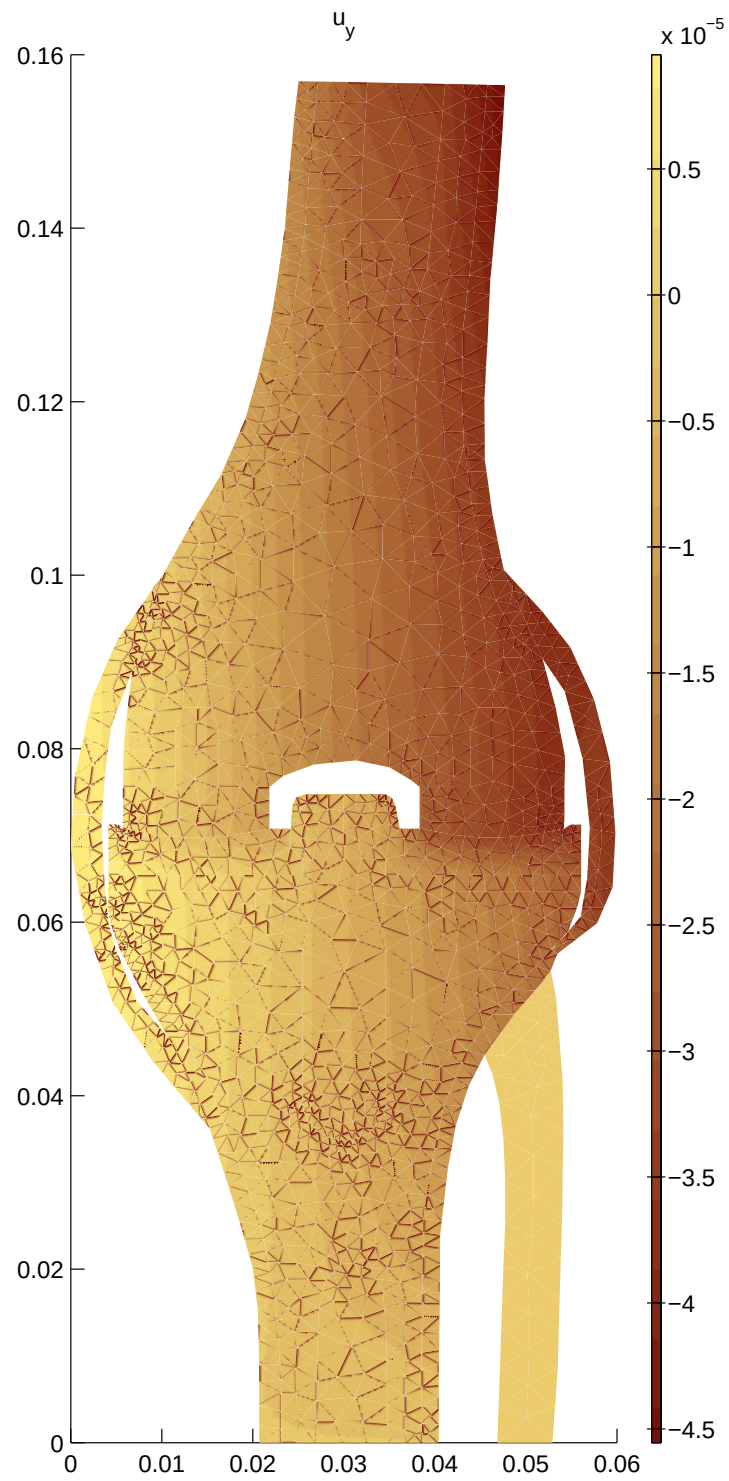


Figure 61: Model V - Vertical component of displacement

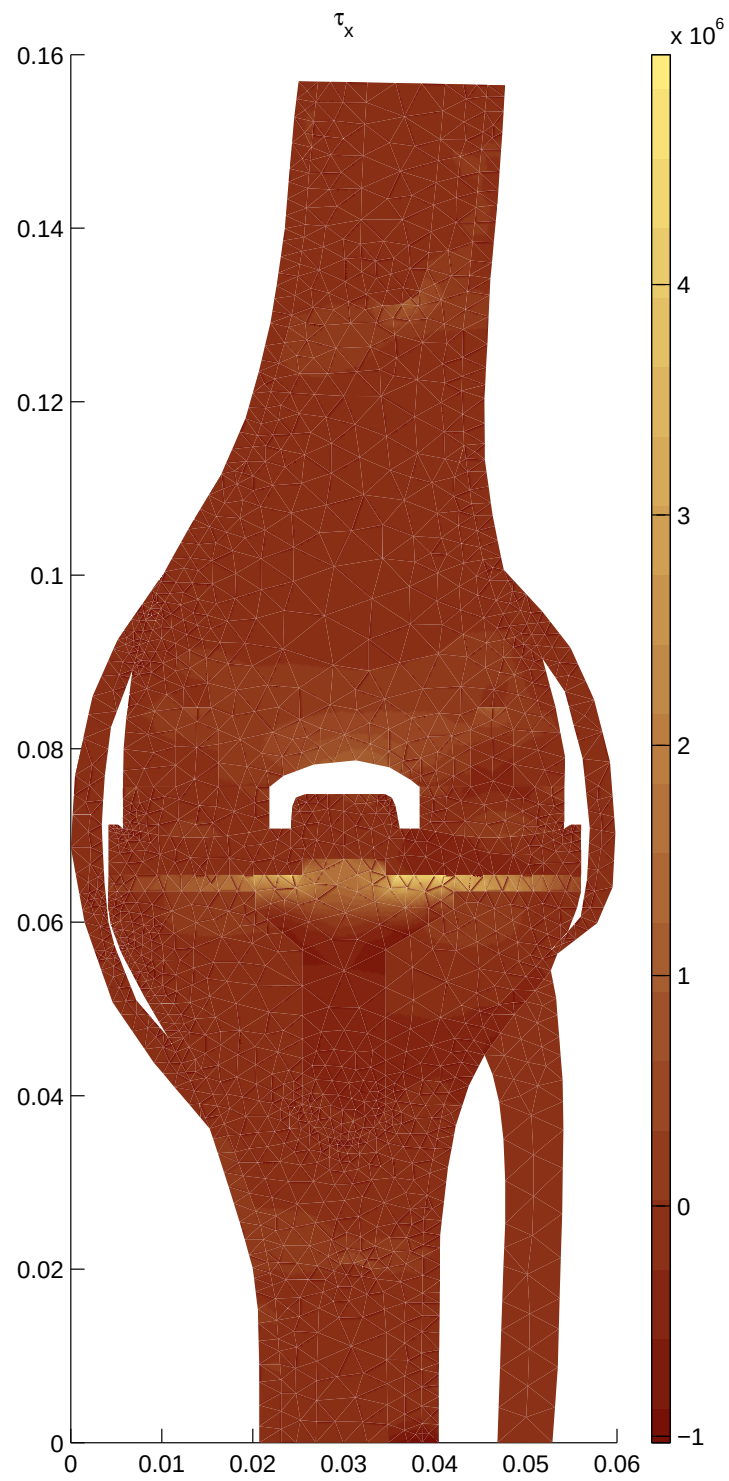


Figure 62: Model V - Stresses τ_x

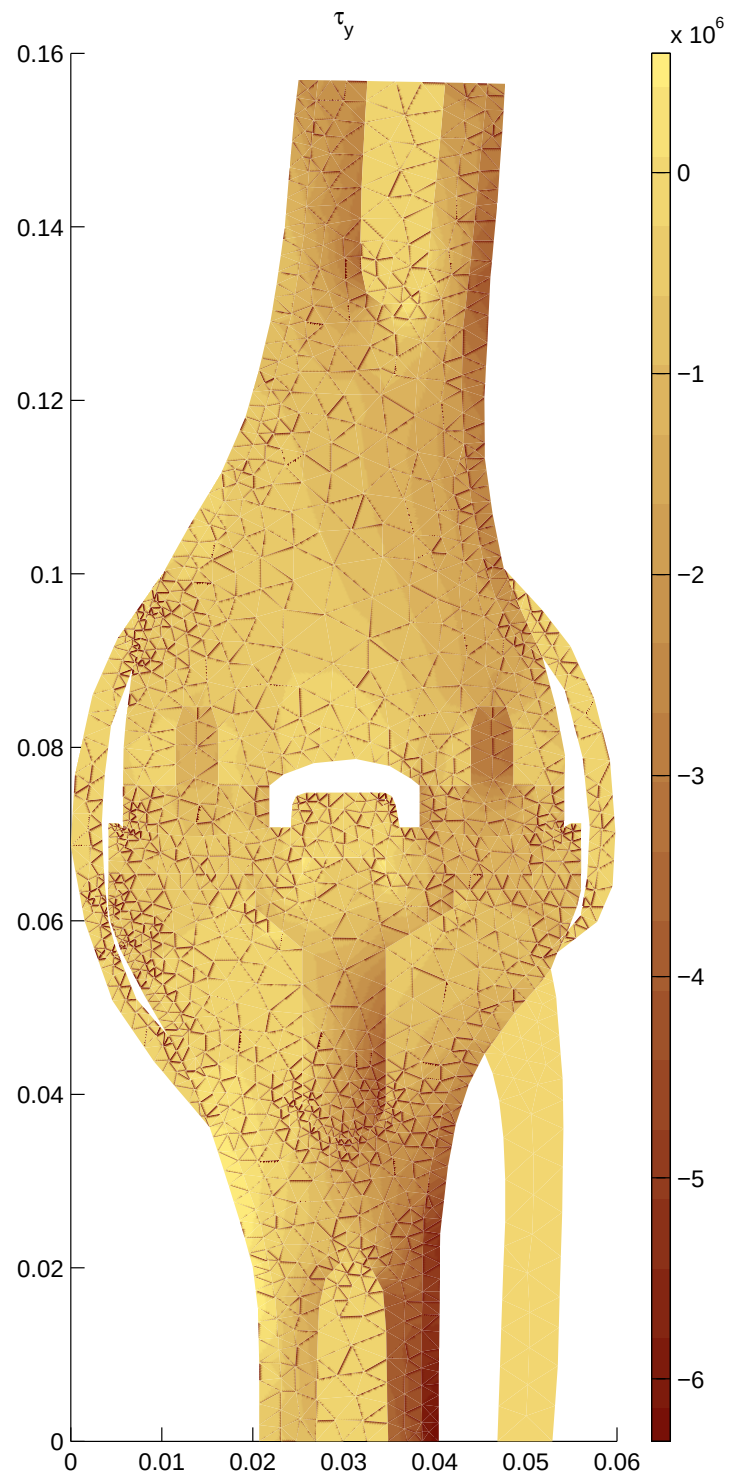


Figure 63: Model V - Stresses τ_y

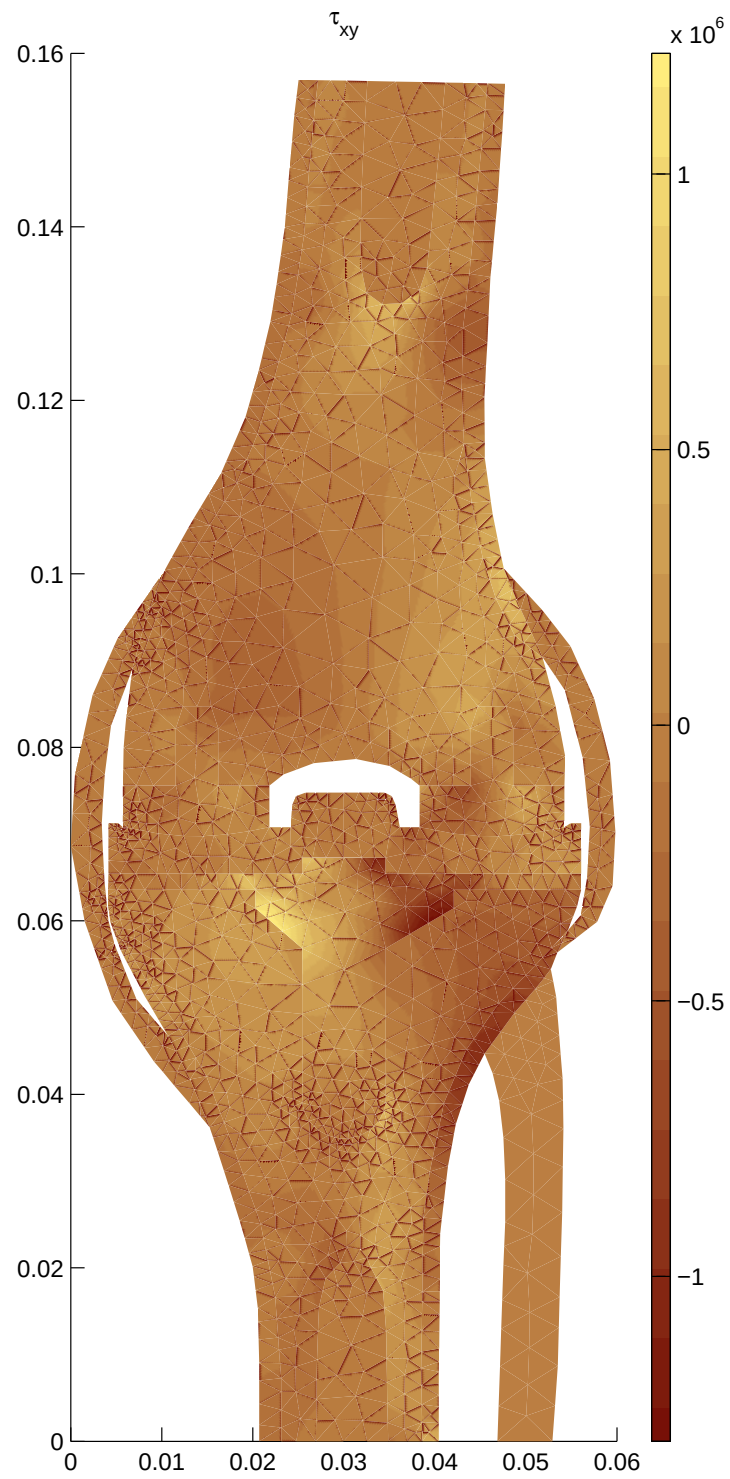


Figure 64: Model V - Stresses τ_{xy}

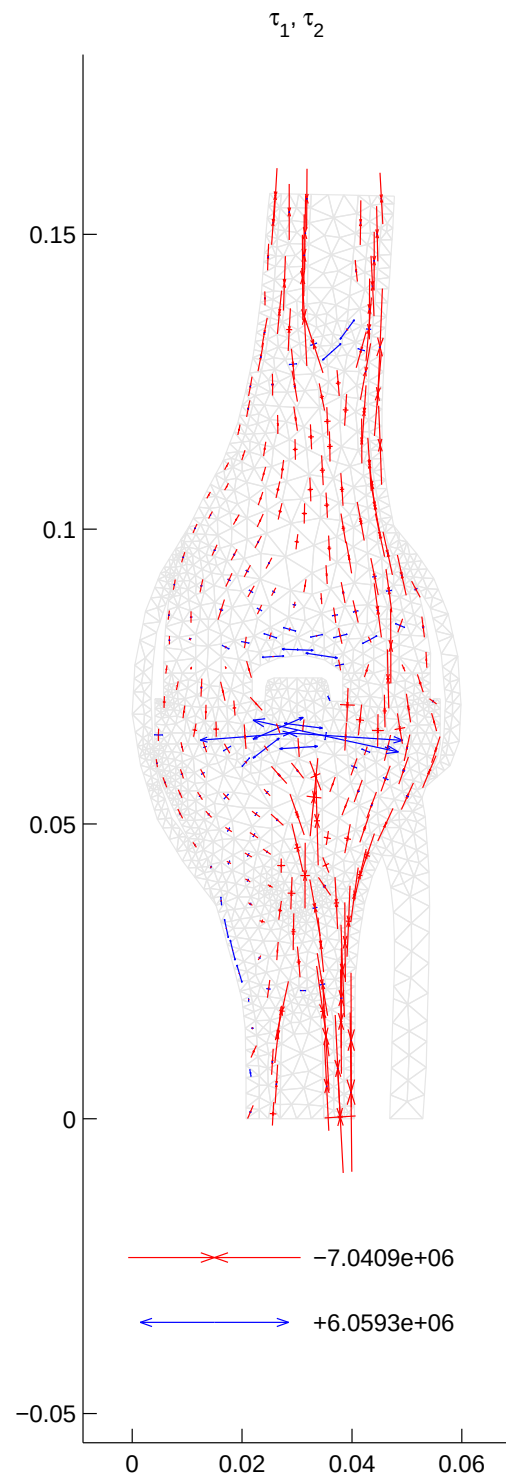


Figure 65: Model V - Principal stresses

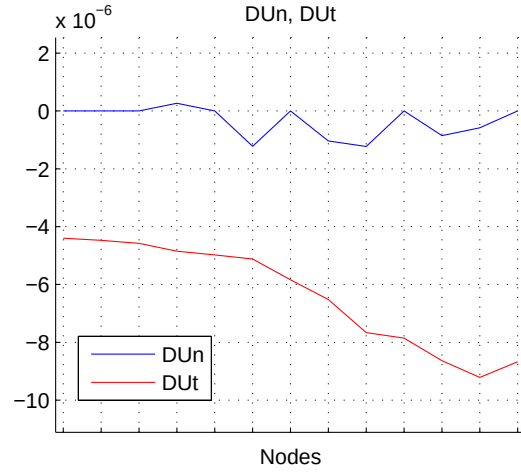


Figure 66: Model V - The normal and tangential components of displacement on the contact boundary 5-6

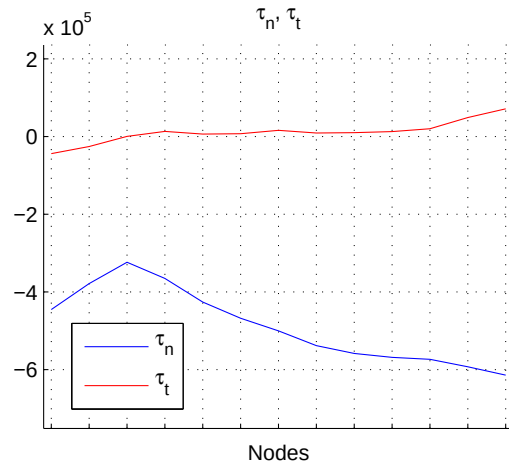


Figure 67: Model V - The normal and tangential components of stress vector on the contact boundary 5-6

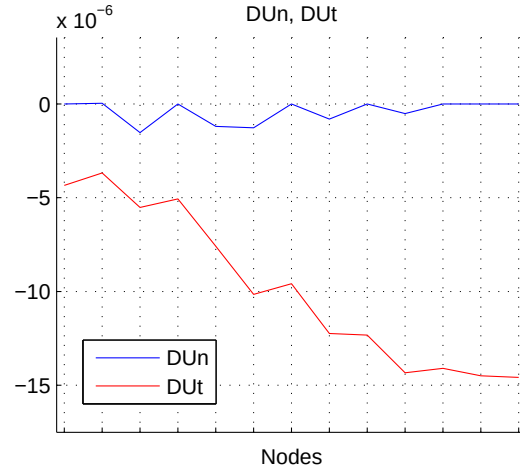


Figure 68: Model V - The normal and tangential components of displacement on the contact boundary 7-8

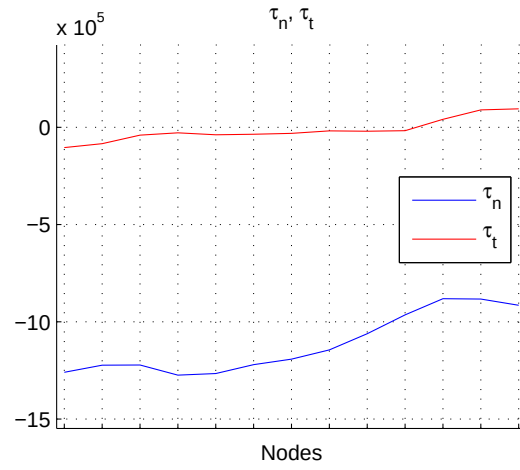


Figure 69: Model V - The normal and tangential components of stress vector on the contact boundary 7-8

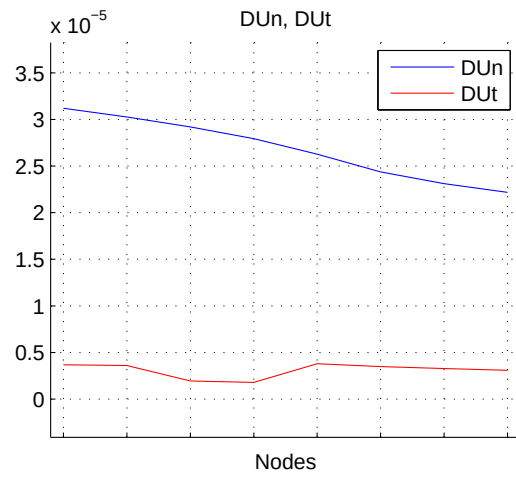


Figure 70: Model V - The normal and tangential components of displacement on the contact boundary 9-10

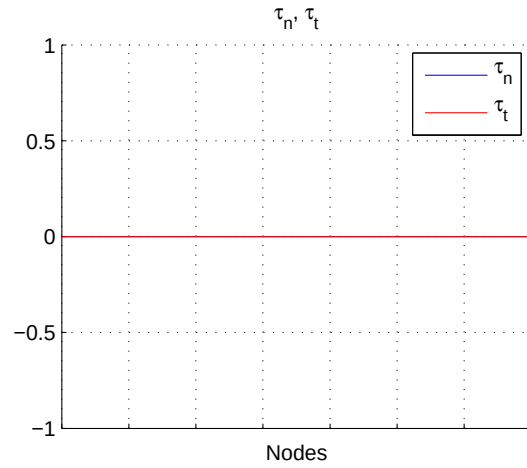


Figure 71: Model V - The normal and tangential components of stress vector on the contact boundary 9-10