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Computational simulation of different parameters influencing the contact stress distribution

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SUMMARY

The paper investigates the influence of the different parameters on distribution of stresses in the contact area of mechanical elements by means of a computational simulation. The study is aimed to determine particular positions in the contacting bodies, where the likelihood of irrecoverable damage is the highest due to large stresses resulting from different contact conditions. A two-dimensional equivalent contact model is used for all computational analyses utilising the finite element method. The stress field in the contact area can be more easily determined by applying the standard Hertz contact theory, along with general-purpose finite element codes. The distribution of the maximum equivalent von Mises stress under the contacting area is first determined for pure Hertzian contact conditions, where the maximum stresses appear at a certain depth under the contacting surface. Then a parametric study is performed to determine the influence of loading, contact surface curvature, contact friction, residual stresses and elasto-hydro-dynamic lubrication on the stress distribution. From this study it follows that high contact pressures, small contact surface curvature radii, high friction, tensile residual stresses, high mean velocities of contacting surfaces and high kinematic viscosity have a negative influence on the stress distribution. They tend to increase the stresses and move their maximum to the contacting surface or very close to it. Guidelines for choosing the appropriate contact parameters are given for the treated examples.