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Numerical and experimental analysis of stress fields in mechanical contacts between solids (rigid/deformable and deformable/deformable)

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This paper deals with contact problems between solids. This type of problem can be encountered in mechanical systems where contact between moving components can give rise to high stresses, particularly in the neighborhood of contact zones. The analyzed model consists of a birefringent epoxy disk under diametric compression between two plates, one made of a birefringent epoxy and the other one made of steel. The model allows therefore analyzing on a polariscope, with plan polarized light and circularly polarized light, both types of contact (rigid/deformable and deformable/deformable). A numerical solution is used to determine stresses in the whole model, particularly in the neighborhood of the contact zones. Simulated isochromatic fringes and isoclinic fringes are compared to the experimental ones obtained on the analyzer of a polariscope. Relatively good agreements are achieved between the experimental solution and the finite element solution; by zooming on the contact zones one can see that photoelastic fringes show clearly the areas of maximum shear stresses and their relative positions in the neighborhood of the contact zones. The blue color on the simulated photoelastic fringes corresponds to the dark color on the experimental fringes. Comparison is also made with theoretical results obtained by Hertz theory of contact.

Keywords
Contact stress, Birefringent, Isochromatic, isoclinic, Simulation

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