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Photoelastic and numerical stress analysis of a pin on a plan contact subjected to a normal and a tangential load

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Theoretical studies of contact stresses can be in some cases very complex. Several methods, experimental as well as numerical, have then be used to analyze these types of problems. In this paper two methods have been used: the photoelasticity method and the finite element method. Stresses were determined in the neighborhood of the contact zone for a plan subjected to a normal load and a tangential load via a pin of rectangular cross section. The purpose here is to study the effect of applying simultaneously a normal and a tangential load on the stress field developed in the plan. In the finite element solution, the pin made of aluminum was considered to be rigid relatively to the plan which is made of a birefringent material necessary to analyze optically the model stresses. The photoelastic fringes obtained on the analyzer of a polariscope allowed us to obtain stress values on the plan, particularly in the neighborhood of the contact zone, in order to compare them with the numerical results. Comparisons were also made between experimental and simulated isochromatic and isoclinic fringes. Relatively good agreements have been observed. Problems with more complicated geometries can therefore be studied numerically. Good care should be taken though when dealing with the limit conditions to achieve better simulation.

Keywords
Photoelasticity, Birefringent, Contact stress, Simulation

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