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Multi-Parametric Patterns of Photoelastic Isotropic Points in Disk Under Four-Point Loading

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Photoelastic isotropic points (IPs) capable of holding information of mechanical contacts at sufficiently far-away are focused. Four-point asymmetrically loaded circular disk is chosen for analysis and demonstration. Aim is to quantify normal reactions and friction at four independent contacts, and understand IPs formation patterns in simpler cases of loading. Photoelastic experiment on four-point loaded disk together with digital image processing lays down required input data. An analytical method for stress state in disk is extended to capture IPs coordinates in simplified loading cases as functions of parametric angles. Characteristic equation for IP coordinates is polynomial equation in all symmetric cases. IPs pair in radially loaded disk with symmetry axis forms only on symmetry axis, coalesce into single IP or split away from the axis, depending on loading angles. Symmetric tangential loading exhibits significant difference from normal loading with formation of three IPs including an everforming central IP.