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The method of linear conjugation of analytical functions of complex variable was used to solve the problem of circular transversally isotropic plate bending hinged on the edge and loaded over the outer surface by the force distributed along the concentric curve. The complex potentials employed for registering the stress and deformation characteristics of the problem can possess the specific features at the concentrated force loading points, their nature was investigated and applied to the existing loading as conditionally concentrated. For getting the solution, the equation for the refined transtropic plate bending model was used that includes transverse shear strains and cross-sectional reductions, and, unlike other refined theories, the formulas with those refinements are advanced. The constants in the complex potentials were established with the boundary conditions and conjugation conditions for the moments and generalized angles of cross-section rotation along the loading line. With the approach by Timoshenko and Woinowsky-Krieger, from the circular loading solution, as a particular case, the solution for the centered concentrated force-loaded plate was obtained. For both cases, the refined normal radial and circumferential stresses were calculated in the center and on the edge of the plate. The data are summarized in tables and graphs. The model and numerical results show that an increase in the transverse plate anisotropy can radically change stress distribution patterns in its transverse cross-sections, up to the change in the radial stress signs on the outer surfaces. The classical model of plate bending and refined models such as by Timoshenko and Reissner are inapplicable in this case.