

## Exact Nonlinear Theory of Bending and Torsion of Elastic Rods

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The Saint–Venant's problems for prismatic rod, rod as sector of a circular ring and rod in the shape of a helical spring are considered on the basis of exact three-dimensional equations of nonlinear elasticity. By the Saint–Venant's problems we mean here problems of large tension, bending and torsion deformations of prismatic and curved beams loaded with end forces and moments. The central point of the investigation is the semi-inverse solution of three-dimensional equations of a non-linearly elastic body statics. The solutions found represent two-parameteric sets of finite deformations defined by Cartesian, cylindrical or special curvilinear coordinates. At these deformations the initial three-dimensional system of nonlinear equilibrium equations is reduced to a system of equations with two independent variables. By means of semi–inverse solutions, spatial problems of nonlinear elastostatics are reduced to two–dimensional boundary value problems for flat domain in the shape of cross-section of a prismatic or curved rod. The numerical solutions of two-dimensional boundary value problems on a cross-section of a beam are found with the use of variational methods of nonlinear elasticity. The results listed above are also extended to nonlinearly elastic bodies with microstructure possessing couple stress.

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