

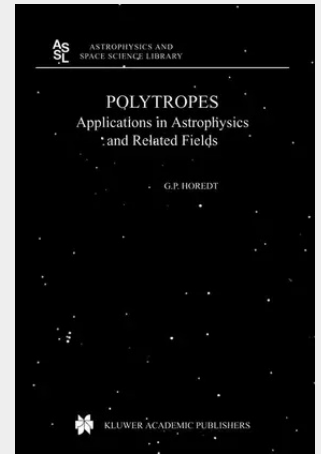
Horedt

Polytropes

Applications in Astrophysics and Related Fields

While it seems possible to present a fairly complete unified theory of undistorted polytropes, as attempted in the previous chapter, the theory of distorted polytropes is much more extended and sophisticated, so that I present merely a brief overview of the theories that seem to me most interesting and important. Basically, the methods proposed to study the hydrostatic equilibrium of a distorted self-gravitating mass can be divided into two major groups (Blinnikov 1975): (i) Analytic or semi-analytic methods using a small parameter connected with the distortion of the polytrope. (ii) More or less accurate numerical methods. Lyapunov and later Carleman (see Jardetzky 1958, p. 13) have demonstrated that a sphere is a unique solution to the problem of hydrostatic equilibrium for a fluid mass at rest in tridimensional space. The problem complicates enormously if the sphere is rotating rigidly or differentially in space round an axis, and/or if it is distorted magnetically or tidally. Even for the simplest case of a uniformly rotating fluid body with constant density not all possible solutions have been found (Zharkov and Trubitsyn 1978, p. 222). The sphere becomes an oblate spheroid, and we have no a priori knowledge of its stratification, boundary shape, planes of symmetry, transfer of angular momentum in differentially rotating bodies, etc.

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