fluid as an ideal (non-viscous) fluid. No doubt that the viscous treatment of the cosmological background should have many essential consequences [30]. The thermodynamical ones, for instance, can profoundly modify the dynamics and configurations of the whole cosmological background [31]. The reason is obvious. The bulk viscosity is to be expressed as a function of the Universe energy density ρ [32]. Much progress has been achieved in relativistic thermodynamics of dissipative fluids. The pioneering theories of Eckart [1] and Landau and Lifshitz [2] suffer from lake of causality constrains. The currently used theory is the Israel and Stewart theory [3, 4], in which the causality is conserved and theory itself seems to be stable [5, 7].

In this article, we aim to investigate the effects that bulk viscosity has on the Early Universe. We consider a background corresponding to a FRW model filled with ultra-relativistic viscous matter, whose bulk viscosity and equation of state have been deduced from recent heavy-ion collisions experiments and lattice QCD simulations.

The present paper is organized as follows. The basic equations of the model are written down in Section II. In Section III we present an approximate solution of the evolution equation. Section IV is devoted to one particular solution, in which we assume that $H = const$. The results and conclusions are given in Sections VI and VII, respectively.

II. EVOLUTION EQUATIONS

We assume that geometry of the early Universe is filled with a bulk viscous cosmological fluid, which can be described by a spatially flat FRW type metric given by

$$ds^2 = dt^2 - a^2(t)\left[dr^2 + r^2\left(d\theta^2 + \sin^2\theta d\phi^2\right)\right]. \tag{1}$$

The Einstein gravitational field equations are:

$$R_{ik} - \frac{1}{2} g_{ik} R = 8\pi G T_{ik}. \tag{2}$$

In rest of this article, we take into consideration natural units, i.e., $c = 1$, for instance.

The energy-momentum tensor of the bulk viscous cosmological fluid filling the very early Universe is given by

$$T_i^k = (\rho + p + \Pi) u_i u^k - (p + \Pi) \delta_i^k, \tag{3}$$

where i, k takes $0, 1, 2, 3$, ρ is the mass density, p the thermodynamic pressure, Π the bulk viscous pressure and u_i the four velocity satisfying the condition $u_i u^i = 1$. The particle and