where ψ_B and ψ_l are the baryon and lepton fields, respectively. The index B runs over the baryon octet (p, n, Λ, Σ^+, Σ^0, Σ^-, Ξ^0, Ξ^-), and the sum on l is over electrons and muons (e^- and μ^-). The field tensors of the vector mesons, ω, ρ, and ϕ, are denoted by $W_{\mu\nu}$, $R_{i\mu\nu}$, and $S_{\mu\nu}$, respectively. In the RMF approach, the meson fields are treated as classical fields, and the field operators are replaced by their expectation values. The meson field equations in uniform matter have the following form:

$$m_\sigma^2\sigma + g_2\sigma^2 + g_3\sigma^3 = -\sum_B \frac{g_{\sigma B}}{\pi^2}\int_0^{k_F^B} \frac{m_B^*}{\sqrt{k^2+m_B^{*2}}}k^2 dk, \tag{2}$$

$$m_\omega^2\omega + c_3\omega^3 = \sum_B \frac{g_{\omega B}\left(k_F^B\right)^3}{3\pi^2}, \tag{3}$$

$$m_\rho^2\rho = \sum_B \frac{g_{\rho B}\tau_{3B}\left(k_F^B\right)^3}{3\pi^2}, \tag{4}$$

$$m_{\sigma^*}^2\sigma^* = -\sum_B \frac{g_{\sigma^* B}}{\pi^2}\int_0^{k_F^B} \frac{m_B^*}{\sqrt{k^2+m_B^{*2}}}k^2 dk, \tag{5}$$

$$m_\phi^2\phi = \sum_B \frac{g_{\phi B}\left(k_F^B\right)^3}{3\pi^2}, \tag{6}$$

where $\sigma = \langle\sigma\rangle$, $\omega = \langle\omega^0\rangle$, $\rho = \langle\rho_{30}\rangle$, $\sigma^* = \langle\sigma^*\rangle$, and $\phi = \langle\phi^0\rangle$ are the nonvanishing expectation values of meson fields in uniform matter; $m_B^* = m_B + g_{\sigma B}\sigma + g_{\sigma^* B}\sigma^*$ is the effective mass of the baryon species B, and k_F^B is the corresponding Fermi momentum.

The meson-baryon coupling constants play an important role in determining the properties of neutron star matter. To examine the influence of the RMF parameters, we employ two successful parameter sets, TM1 [37] and NL3 [38], in the present calculation. These parameters have been determined by fitting to some ground-state properties of finite nuclei, and they can provide a good description of nuclear matter and finite nuclei, including unstable nuclei. With the TM1 (NL3) parameter set, the nuclear matter saturation density is 0.145 fm^{-3} (0.148 fm^{-3}), the energy per nucleon is -16.3 MeV (-16.3 MeV), the symmetry energy is 36.9 MeV (37.4 MeV), and the incompressibility is 281 MeV (272 MeV) [37, 38]. As for the meson-hyperon couplings, we take the naive quark model values for the vector