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$f(R)$ cosmology revisited

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I shall present various results concerning the analysis of several $f(R)$ models in a FRW spacetime. The analysis is based on an approach where the $f(R)$ theory is not mapped to a Scalar-Tensor Theory in order to avoid the use of potentials that may be ill defined (e.g multivalued). Thus, the Ricci scalar itself is one of the fundamental variables instead of the scalar $f'(R)$. The system of equations is then solved numerically as an initial value problem constrained by the modified-gravity Hamiltonian. This in turn is used to monitor the accuracy of the numerical integration at every time step. Among the results I shall present are the behaviour of the matter-dominated and accelerated eras, the age of the Universe and the confrontation with SNIa data. I intend to discuss the differences and similarities of our findings relative to previous results.