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Classifying Robertson-Walker scale factor using Noether's approach

The universe can be depicted in the best way by using Friedmann-Robertson-Walker (FRW) models. FRW models of the universe are considered to have properties like homogeneity and isotropy. The universe is continuously expanding which can be represented by considering Robertson-Walker scale factor. Robertson-Walker scale factor is the function of time 't'. The scale factor is useful to define red shift and the Hubble parameter. The Hubble parameter gives information about the evolution of the universe and is also useful in calculating the age of the universe. In present research work, Noether's approach was applied to classify FRW spacetime. The spacetime was considered for three types of universe i.e. closed, open, and flat. For closed, open and flat universe, curvature parameter 'k' was -1, 1, and 0 respectively. Different values of Robertson-Walker scale factor were considered which gave the nontrivial symmetries. By using Noether equation and Perturbed Lagrangian an over-determined system of partial differential equations were obtained. For the closed, open and flat universe, maximal and minimal set of Noether operators were acquired. For every Noether operator, the corresponding energy type first integral of motion was calculated.