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Analytic integrability of Bianchi class A cosmological models with $k = 1$ [☆]

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ABSTRACT

We complete the study of the analytic integrability of the Class A of Bianchi cosmological models with $k = 1$, characterizing the analytic first integrals of the Bianchi types VI_0 and $VIII_0$.

1. Introduction and statement of the main result

A cosmological model describes the universe and is defined by the space time geometry (determined by a metric), the presence of matter and its physical behaviour (determined by the energy–momentum tensor), and the interaction between geometry and matter (described through the Einstein's equations).

Friedmann in 1922 introduced the study of homogeneous cosmologies. For spatially homogeneous cosmologies, the Einstein field equations can be written as an autonomous system of first order differential equations; see [1] and the references therein.

Bianchi models describe space–times which are foliated by homogeneous hypersurfaces of constant time. Homogeneity requires a three dimensional isometry group (and so a three dimensional Lie algebra). Bianchi [2,3] was the first to solve the problem of classifying three dimensional Lie algebras which are non-isomorphic. The classification is determined by the dimension n of the algebra. There are nine types of models according to n:

(a) $n = 0$: type I;
(b) $n = 1$: types II, III;
(c) $n = 2$: types IV, V, VI, VII;
(d) $n = 3$: types VIII, IX.

The types I,V and IX contain as special cases the Friedmann–Robertson–Walker universes; see [4].

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