UDC 517.1, 514.76

MATEMATICHESKIE TRUDY
2014, V. 17, N 2, 41–60

FUNCTIONS WITH (NON)TIMELIKE GRADIENT ON A SPACE-TIME

V. N. Berestovskiĭ and I. A. Zubareva

We consider some generalization of a problem proposed by V. A. Toponogov for functions with nontimelike gradient on a globally hyperbolic space-time and a specific application of the positive solution of this problem to the cases of a Minkowski space-time and a de Sitter space-time of the first kind. Examples of smooth functions with timelike gradient on Lorentz manifolds are given. The authors obtain some sufficient conditions for level surfaces of functions with timelike gradient on a Lorentz manifold which guarantee that the manifold is globally hyperbolic. A description of the past and the future event horizons for timelike geodesics in a de Sitter space-time of the first kind is given. Some unsolved problems are formulated.

Key words and phrases: globally hyperbolic space-time, Cauchy surface, (non)timelike gradient, Lorentz manifold, level surface, de Sitter space-time of the first kind, world line, event horizon

Berestovskij Valerij Nikolaevich
Zubareva Irina Aleksandrovna

Sobolev Institute of Mathematics,
Omsk Division,
Omsk, 644099, Russia.
E-mail: berestov@ofim.oscsbras.ru;
E-mail: i_gribanova@mail.ru

Received
December 25, 2013

Translated into English:
Siberian Advances in Mathematics, V. 25, N 4, 243–254 (2015).
DOI: 10.3103/S1055134415040021