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of analysis»

Book of abstracts



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LIST OF TOPICS

- Algebraic methods in geometry
- Differential geometry in the large
- Geometry and topology of differentiable manifolds
- General and algebraic topology
- Dynamical systems and their applications
- Geometric problems in mathematical analysis
- Geometric and topological methods in natural sciences
- History and methodology of teaching in mathematics

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НТБ ОНАФТ

Theory of gravity in the affine frame

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Let $e_a = h_a^\mu \partial_\mu$ by the affine frame in the Riemann space, $g_{ab} = e_a \cdot e_b$ and $F_{\mu\nu}^a = \partial_\nu h_\mu^a - \partial_\mu h_\nu^a$ – non-holonomy coefficients. Suppose, that γ_{bc}^a is coefficients of the torsion-free and metric-compatible affine connection in the affine frame e_a , so $F_{bc}^a = \gamma_{bc}^a - \gamma_{cb}^a$ and $g_{ab,c} = \gamma_{acb} + \gamma_{bca}$. The Riemann curvature scalar $R = \delta_{ab}^{\mu\nu} g^{bd} (\partial_\mu \gamma_{\nu d}^a + \gamma_{\mu c}^a \gamma_{\nu d}^c)$, where $\delta_{ab}^{\mu\nu}$ – alternator, decompose into $R = -L_\gamma + \frac{1}{e} \partial_\mu (e V^\mu)$, where $e^2 = \det\{g_{ab} h_\mu^a h_\nu^b\}$ and $V^\mu = \gamma_{cc}^\mu - \gamma_c^\mu$. Function

$$L_\gamma = \delta_{ab}^{\mu\nu} g^{bd} \gamma_{\mu c}^a \gamma_{\nu d}^c$$

plays the role of Lagrangian in the theory of gravity in the affine frame (TGAF).

Let's consider T^g -transformations:

$$\begin{aligned} \delta x^\mu &= h_a^\mu t^a, \\ \delta h_\mu^b &= -F_{\mu a}^b t^a - \partial_\mu t^a, \\ \delta g_{bc} &= -g_{bc,a} t^a \end{aligned}$$

with infinitesimal parameters t^a . Lagrangian L_γ is invariant under this transformations, so take place the strong Noether's identity

$$t_a^\mu + \nabla_\sigma B_a^{\mu\sigma} = -G_a^\mu,$$

where

$$t_a^\mu = B_b^{\sigma\mu} F_{\sigma a}^b + D^{bc\mu} \gamma_{bac} - L_\gamma h_a^\mu$$

is the energy-momentum tensor of the gravitational field in TGAR,

$$B_a^{\mu\sigma} = \delta_{\rho\nu}^{\mu\sigma} (\gamma_a^{\rho\nu} + h_a^\rho V^\nu),$$

$$D^{bc\mu} = -(\gamma^{\mu bc} + \gamma^{\mu cb}) + h_a^\mu (g^{db} \gamma_a^{ac} + g^{dc} \gamma_a^{ab}) + g^{bc} V^\mu$$

and G_a^μ – Einstein tensor. On the gravitational extremal $G_a^\mu = \tau_a^\mu$, where τ_a^μ – energy-momentum tensor of matter fields, we obtain the equation for gravitation field in TGAR:

$$\partial_\sigma (e B_a^{\mu\sigma}) = -e T_a^\mu,$$

where $T_a^\mu = t_a^\mu + \tau_a^\mu$ is the complete energy-momentum tensor of the gravitational and matter fields, and $e B_a^{\mu\sigma}$ plays the role of its superpotential. This equation has the form of Maxwell equations and equations of gauge theory of gravity in the orthonormal frame [1].

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