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Abstracts

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MULTIDIMENSIONAL RIEMANNIAN METRICS IN THEORY OF THE NAVIER-STOKES EQUATIONS

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To integrating of Navier-Stokes equations on base of $14D$-the Ricci-flat $R_{ik} = 0$ metrics we use the $6D$ and $4D$- the Ricci-flat metrics, associated with the KP- and KdV-equations defined by the system of linear equations of the form $\frac{\partial}{\partial y}\psi(x,y,z) + \frac{\partial^2}{\partial x^2}\psi(x,y,z) - 4/3\,\frac{\partial}{\partial x}h(x,y,z) = 0$, $\frac{\partial}{\partial z}\psi(x,y,z) - \frac{\partial}{\partial y}h(x,y,z) - \frac{\partial^3}{\partial x^3}\psi(x,y,z)$ $-3/2\,\psi(x,y,z)\,\frac{\partial}{\partial x}\psi(x,y,z) + \frac{\partial^2}{\partial x^2}h(x,y,z) = 0$, and which is used then to construct solutions of the KP and KdV -equation.

$$6\,\psi(x,y,z)\,\frac{\partial^2}{\partial x^2}\psi(x,y,z) + 6\left(\frac{\partial}{\partial x}\psi(x,y,z)\right)^2 + 3\,\frac{\partial^2}{\partial y^2}\psi(x,y,z) -$$

$$4\,\frac{\partial^2}{\partial z\partial x}\psi(x,y,z) + \frac{\partial^4}{\partial x^4}\psi(x,y,z) = 0.$$

$$\frac{\partial}{\partial z}\psi(x,y,z) - \frac{\partial}{\partial y}h(x,y,z) - \frac{\partial^3}{\partial x^3}\psi(x,y,z) - 3/2\,\psi(x,y,z)\,\frac{\partial}{\partial x}\psi(x,y,z) +$$

$$\frac{\partial^2}{\partial x^2}h(x,y,z) = 0.$$

For the KP-equation we get

$$6\psi(x,y,z)\frac{\partial^2}{\partial x^2}\psi(x,y,z) + 6(\frac{\partial}{\partial x}\psi(x,y,z))^2 + 3\frac{\partial^2}{\partial y^2}\psi(x,y,z) - 4\frac{\partial^2}{\partial z\partial x}\psi(x,y,z) + \frac{\partial^4}{\partial x^4}\psi(x,y,z) = 0.$$

The Ricci-flat $6D$ metric in the local coordinates (x,y,t,u,v,w) has applications in theory of moduli of Riemann surfaces and corresponding them the Theta-functions of algebraic curves.

To integrating Navier-Stokes equations with help of $14D$ flat metric $R_{ik} = 0$ we use the Ricci flat metrics $6D$ and $4D$-spaces associated with the KP and KdV-equations, defined by the system of linear equations of the form $\frac{\partial}{\partial y}\psi\left(x,y,z\right)+\frac{\partial^2}{\partial x^2}\psi\left(x,y,z\right)-4/3\,\frac{\partial}{\partial x}h\left(x,y,z\right)=0$, $\frac{\partial}{\partial z}\psi\left(x,y,z\right)-\frac{\partial}{\partial y}h\left(x,y,z\right)-\frac{\partial^3}{\partial x^3}\psi\left(x,y,z\right)-3/2\,\psi\left(x,y,z\right)\frac{\partial}{\partial x}\psi\left(x,y,z\right)+\frac{\partial^2}{\partial x^2}h\left(x,y,z\right)=0$.

The Ricci-flat $6D$ metric in the local coordinates (x,y,t,u,v,w) in the theory of moduli of Riemann surfaces and corresponding the Theta-functions of algebraic curves is used. It is in form $ds^2 = 4\,u(\frac{\partial}{\partial x}P(x,y,t))d_xd_t + 2\,d_xd_u + 4u(\frac{\partial}{\partial y}P(x,y,t))d_yd_t + 2\,d_yd_v + (-2uP(x,y,t)\frac{\partial}{\partial x}P(x,y,t) - 2u\frac{\partial^3}{\partial x^3}P(x,y,t) - 2\mu v\frac{\partial}{\partial y}P(x,y,t) + 2\,w\frac{\partial}{\partial x}P(x,y,t))d_t{}^2 + 2d_tdw$. The above property of the linear system is used to construct solutions of the KP equation by the introducing an auxiliary parameter τ. The auxiliary parameter for constructing particular solutions of equations in the partial differential equation was considered earlier in the author's works and it is fairly effective procedure.

TEMPERATURE DEPENDENT ELASTIC AND STRUCTURAL PROPERTIES OF UNIAXIALLY STRAINED GRAPHENE

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Graphene is known for its exceptional material properties, both mechanical and electronic [1,2]. We study the mechanical and structural properties of graphene under the effects of temperature and uniaxial strain, using the formalism of Hamiltonian dynamics, and a symplectic integrator to model the in-plane molecular dynamics of this material in time [3,4]. This method allows fast numerical integration while the numerical error is upper-bounded by a constant for all time [5]. In particular, we quantify the stress-strain response of graphene