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MS4: Non-Classical Problems in Structural Dynamics of Continuous Media

Space-time way to programmable materials

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Abstract: We present the family of structures composed of simple compressed and bent elements, that together exhibit new stress-strain relations. The programmable properties depend mainly on finite displacements and rotations of particles. Both strengthening and weakening, or alternate change of these trends can be given as a task. The space-time finite element method that allows us to write continuous in time equilibrium equations results in efficient algorithms. We will demonstrate both the formulation and example structures as a result.

Such materials can be called smart materials, since their rheological properties can vary in different stages of deformation process. They can be simply manufactured with 3D printers or to a greater extent produced in injection molds. Metamaterials or auxetic materials are next to them in the domain of non-classical materials.

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