**Energy based discontinuous Galerkin methods for complex materials**

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We present a spatial discontinuous Galerkin discretization of wave equations in second order form that relies on a new energy based strategy featuring a direct, mesh-independent approach to defining interelement fluxes. Both energy-conserving and upwind discretizations can be devised. The method comes with optimal a priori error estimates in the energy norm for certain fluxes and we present numerical experiments showing that optimal convergence for certain fluxes. We discuss how the method can be adopted to complex materials including micropolar and magneto-granular crystals and dispersive electromagnetic media. Time permitting, extensions to general Hamiltonian systems will also be discussed.