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TRUSS LATTICE DESIGN UNDER DYNAMIC LOADS WITH ADAPTIVE TIME STEPPING.

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Abstract: We develop a design framework for structures comprised of octet-truss lattices subject to impact loads. We design our lattice by changing the struts cross section area and compute the homogenized properties using an analytical model based on slender struts and a periodic microstructure. A constraint in the variation of design variables is imposed to preserve the homogenization assumption. The lattice design goal is the maximization of the mechanical energy at defined regions. We use an adaptive time stepping scheme to avoid having a fixed time step throughout the optimization, as the CFL condition changes due to the changes in design and adaptive time stepping yields a more accurate and efficient simulation. Classic adaptive time stepping schemes are highly discontinuous. They involve conditional statements and often require several attempts for each time step, making them inadequate for optimization. We use instead algorithms based on well-established techniques from linear feedback control theory which behave more smoothly. We use the fifth-order Runge Kutta scheme Dormand-Prince which contains an embedded error estimate. The optimized results are compared in computational time with a fixed time step approach.