1075-35-1 **Graeme Walter Milton*** (milton@math.utah.edu), Department of Mathematics, Salt Lake City, UT 84112. *Metamaterials: high contrast composites with unusual properties.*

Metamaterials are composites with properties unlike any found in nature. For electromagnetism metamaterials open the door to interesting phenomena such as superlensing and cloaking. Metamaterials can also have an interesting elastodynamic behavior. Their effective mass density can be anisotropic, negative, or even complex. Even the eigenvectors of the effective mass density tensor can vary with frequency. One may use coordinate transformations of the elastodynamic equations to get novel unexpected behavior. A classical propagating wave can have a strange behavior in the new abstract coordinate system. However the problem becomes to find metamaterials which realize the behavior in the new coordinate system. This can be solved at a discrete level, by replacing the original elastic material with a network of masses and springs and then applying transformations to this network. The realization of the transformed network requires a new type of spring, which we call a torque spring. The forces at the end of the torque spring are equal and opposite but not aligned with the line joining the spring ends. We show how torque springs can theoretically be realized. This is joint work with M.Briane A.Cherkaev,F.Guevara Vasquez, D.Onofrei, P.Seppecher and J.R.Willis. (Received August 26, 2011)