

More Metamaterials, More Imaginations

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Frenzel et al. have showed three dimensional chiral mechanical metamaterials with twist degrees beyond Cauchy elasticity (1). Torsional resonance experiments have previously been reported and similar effect was already presented in wet human compact bones by R.S.Lakes in 1982 (2). Frenzel and the researchers imagine controlling Rayleigh-like waves as one of the applications of the research by steering force fields or mechanical waves around obstacles (1,3).

“Miyadaiku,” Japanese traditional professional carpenters who built huge temples and castles, have implemented human bone structures including patella and muscle to be an ideal buffer structure for threats including earthquakes and strong winds (4). The joints of the human bone body perform the ultimate functionality and artistry. Japan has been struck by magnitude 7.0 or greater earthquakes with 46 times in the last 1400 year. Horyuji temple built in 607AD without a single nail (the oldest wooden building in the world) survives such giant earthquakes. The temple uses twisted trees where a combination of left and right twists can make one pillar more robust. Ropes are used as “fascias” for supporting the bone. There are still many unknown recipes in Horyuji temple for survivals.

In the field of VDC(Virtual Design and Construction), BIM (Building Information Modeling) is originated not by the purpose to optimize multidimensional information such as structure, economy, process and so on, but by expressing more imaginations and creations. By merging data of three-dimensional microstructure into the individual parts in BIM platforms such as Autodesk and BIMOBJECT, it allows us to express many architects with new formal logic.

References:

[1] Tobias Frenzel et al., “Three-dimensional mechanical metamaterials with a twist” Science 24 Nov 2017: Vol. 358, Issue 6366, pp. 1072-1074

[2] R. S. Lakes, J. Biomech. Eng. 104, 6-11 (1982)

[3] A. Diatta, S. Guenneau, Appl. Phys. Lett. 105, 021901 (2014)

[4]Miyadaiku:

<https://www.japantimes.co.jp/news/2001/06/03/national/miyadaiku-carpenter-laments-loss-of-traditional-knowledge/#.WiSyPkqWbIU>