Finite Element Simulation Of Numerous Response Of Geometry Based Magnetoelectric Composite

Sai Harsha.S[1], Kondaiah.P[1]

[1]Mahindra University, Telangana, Hyderbad, 500043

Abstract

The Magnetoelectric (ME) composites are a set of multiferroic materials which has combination of three ferroic orders namely magnetic field, mechanical field, and electric field. These magnetoelectric materials accessible in single phase and composite forms. In composite form, the piezoelectric and the piezomagnetic materials will be coupled in the form of particulate, layered, and fiber reinforced format. Based on the type of coupling type and size of the material, the magnetoelectric composites have sparked immense interest in utilizing them for various smart devices, including energy harvesters, ME transducers, antennas, and more. These applications capitalize on the impressive magnetoelectric performance offered by multiferroic structures. In the present work the finite element analysis of three dimensional various layered magnetoelectric composites are modelled and investigated like rectangular, cylindrical layered with segmented piezoelectric patches. In COMSOL Multiphysics, by using the constitutive relations for linear piezoelectric and nonlinear magnetostrictive material the magnetic field (mf), solid mechanics (solid), and electrostatics (es) modules are coupled and investigated the magnetic, mechanical and electric properties of the ME composite respectively. In addition, static nonlinear ME response examined using stationery study and frequency-domain study for different varying magnetic fields. The multiple ME output response are obtained for rectangular layered structure are 817.64, 829.75, 883.03, 705.21 mV⁄(cm.Oe). Similarly, for cylindrical structure,731.24, 735.18 mV⁄(cm.Oe)respectively. The results based on this output, this type of ME composites bears promising applications in wide frequency energy harvesting and magnetic field sensor applications.

Figures used in the abstract

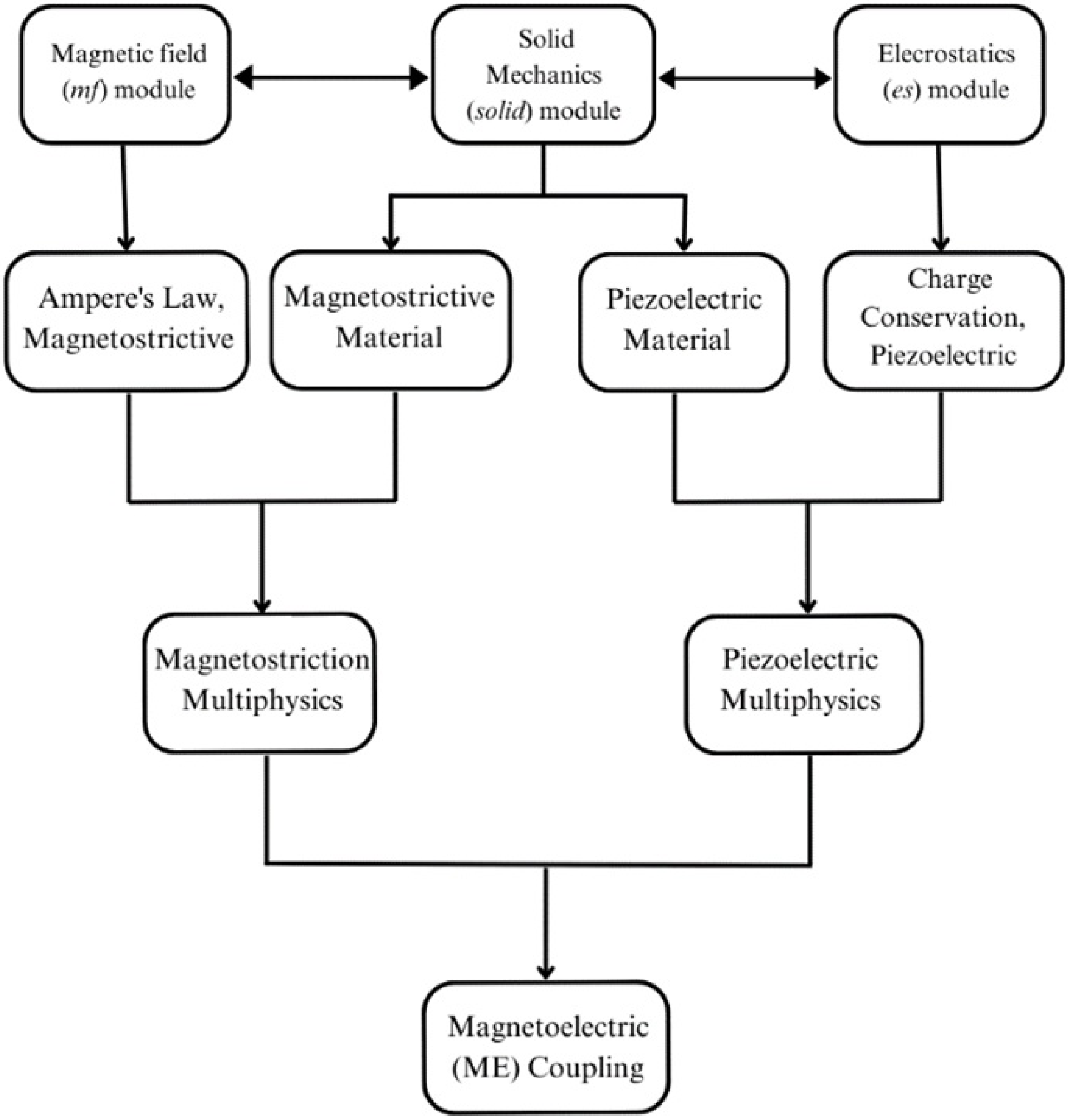

Figure 1 : Flow chart for Coupling of different modules for ME composite

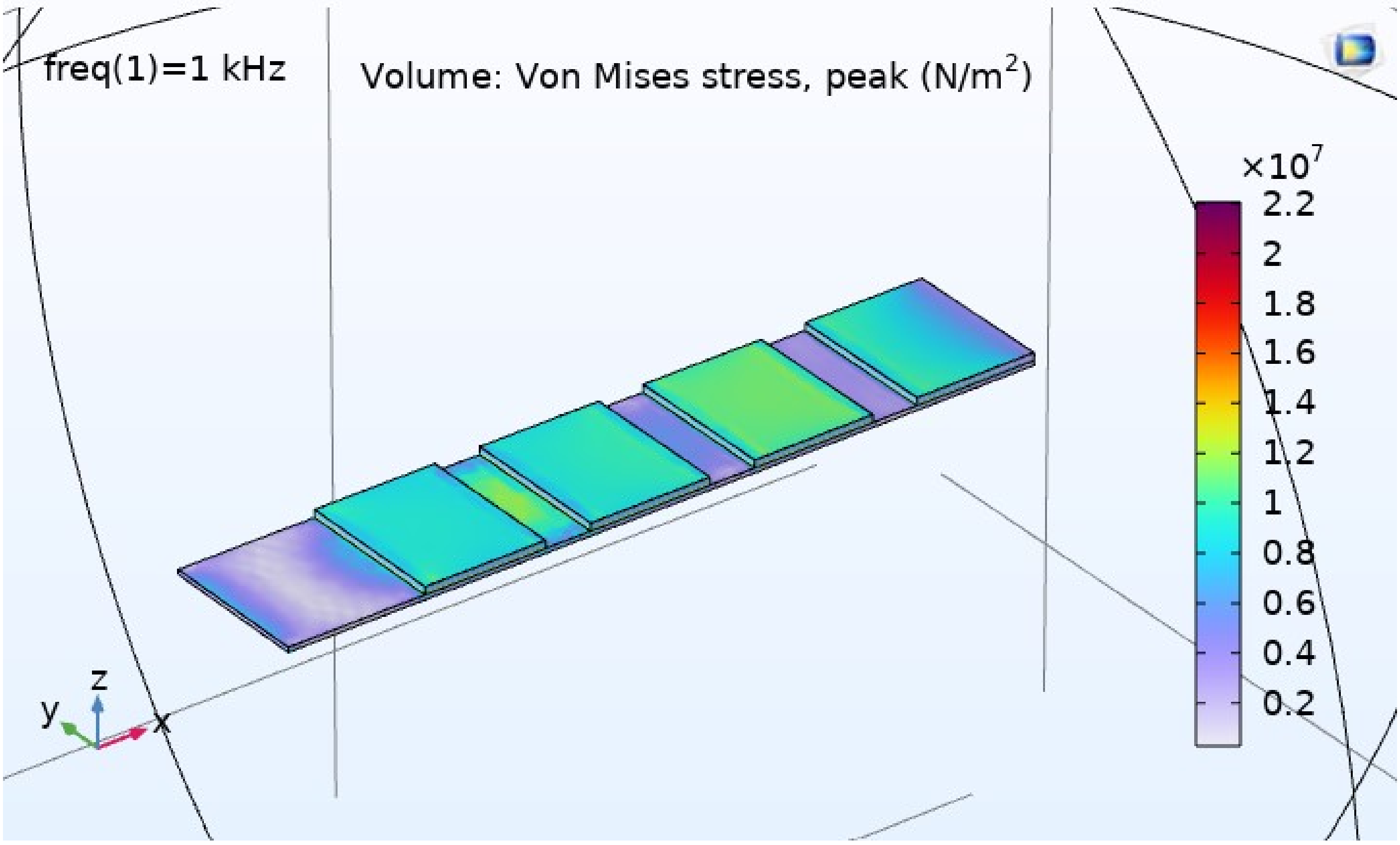

Figure 2 : Stress at optimum magnetic field for Beam ME structure

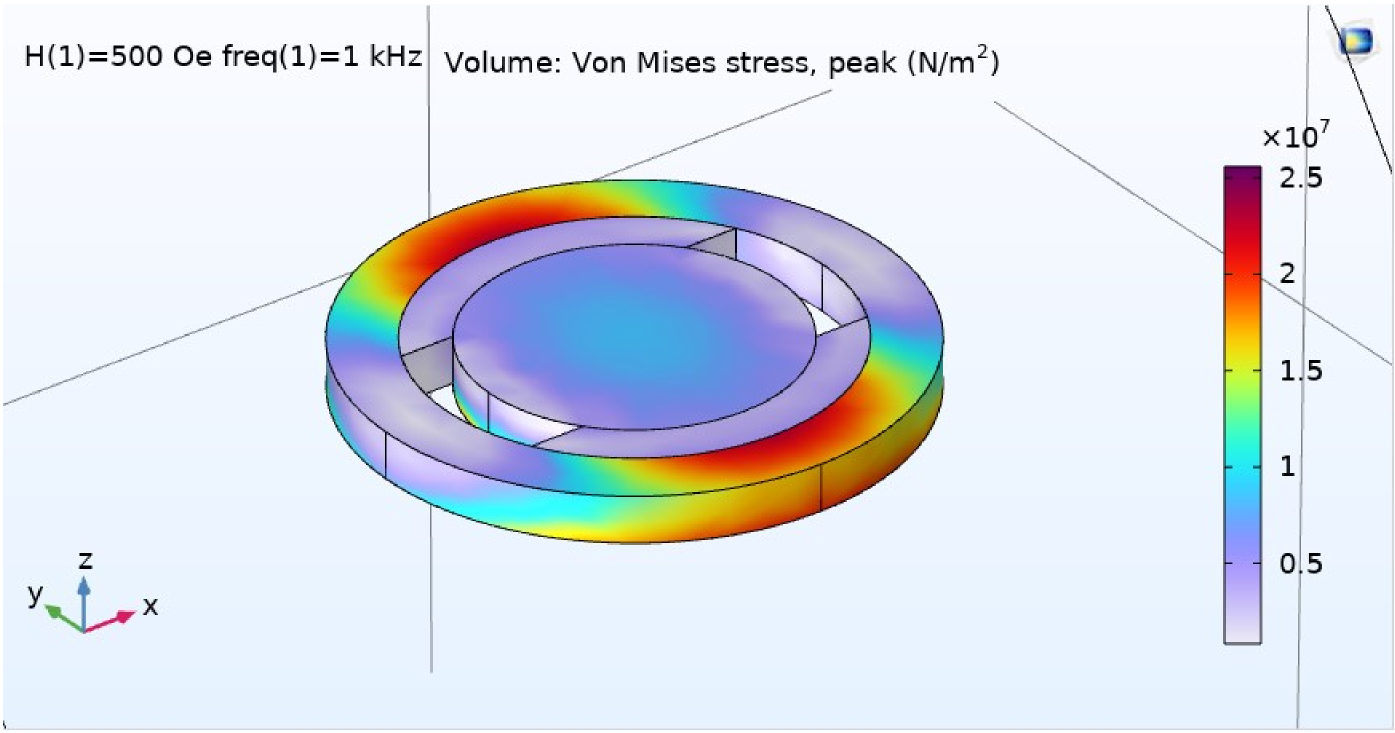

Figure 3 : Stress at optimum magnetic field for cylindrical ME structure