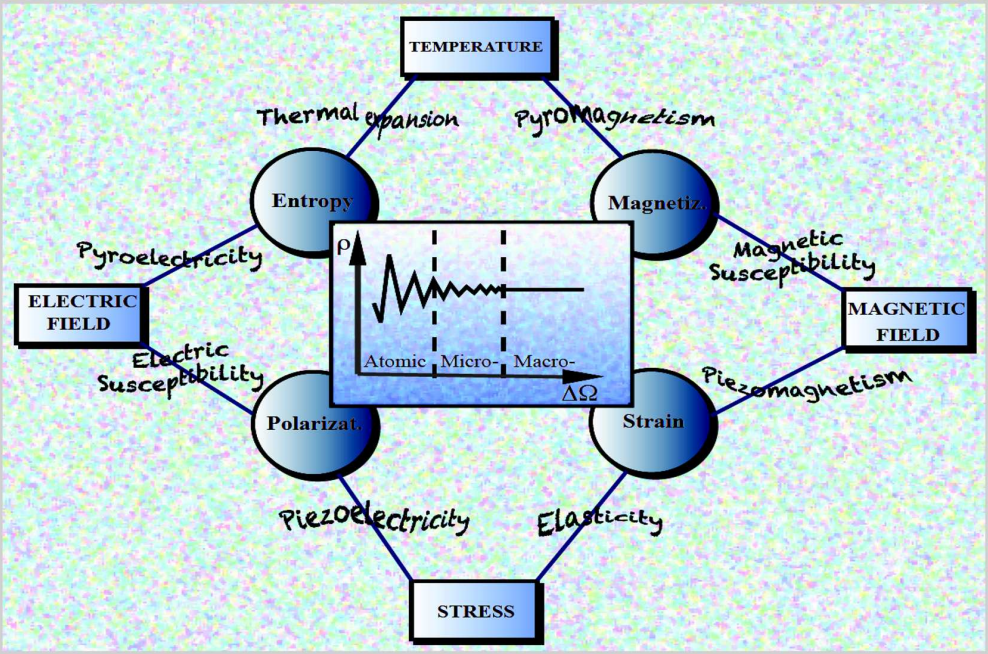
PROGRAMA DE DOCTORADO EN INGENIERÍA CIVIL

MÁSTER DE ESTRUCTURAS

ciencia e ingeniería de estructuras

Cosserat modelling of inhomogeneous flexo-electro-magneto-thermo-elastic media using the Finite Element Method



Dr. Roberto PALMA GUERRERO

Universidad Jaume I - Castellón

Día : Lunes 17 de noviembre 2014
Hora : 12:30h
Lugar : Seminario I, 4ª planta de la , E.T.S. Ing. Caminos, C. y P.
Campus Fuentenueva

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PROGRAMA DE DOCTORADO EN INGENIERÍA CIVIL

MÁSTER DE ESTRUCTURAS

Cosserat modelling of inhomogeneous flexo-electro-magneto-thermo-elastic media using FEM

The use of multi-coupled materials in modern applications is increasing due to their multi-functionality. However, many of these applications use micro-devices and the micro-structure of the materials should be considered. Therefore, the study of multi-coupled materials taking into account their micro-structure is a challenge for the Continuum Mechanics community.

The present work presents a 3D Finite Element formulation to study a fully coupled thermo-electro-magneto-mechanic problem assuming small deformation and taking into account the micro-structure of the medium. For this purpose, a Cosserat micropolar model is considered: macro-continuum is simulated by macro-displacement and micro-continuum by micro-rotations.

From a theoretical point of view, the governing equations are obtained using a Continuum Physics approach. From Mechanics, the linear and angular momentum balance equations are stated. From Electrodynamics, the Maxwell laws are used to obtain the electromagnetic equilibrium equations and the scalar potentials. From Thermodynamics, the entropy balance and the constitutive equations are calculated by assuming small increment of temperature to guarantee reversible (conservative) processes.

From a numerical point of view, standard first-order isoparametric eight node elements with nine degrees of freedom per node (three macro-displacements, three micro-rotations, electric potential, magnetic potential and temperature) are used. Time integrations are solved by using the Newmark-b algorithm and non-linearities, which arise due to the presence of the Maxwell stress tensor, by the Newton-Rhapson.

Roberto Palma Guerrero

Roberto Palma received his Physics (2005), M. Sc. (2006) and Ph.D. (2012) by the University of Granada (Spain). He obtained a research grant FPU by the Ministeriode Educación to develop his postgraduate studies at the Mechanical Engineering department of the University of Granada. Since 2013, he is Assistant Professor in the Universitat Jaume I at Castellón (Spain).

His research has gravitated around thermodynamic formulation for non-linear finite element applied to multi-coupled materials, optimization and inverse modeling,with some incursions in seismic engineering applied to experimental design in High Energy Physics.

He has published 17 papers in refereed journals that have received 117 cites being his h-index 7; 1 book chapter and 19 contributions in conferences. He has participated in 7 research projects supported by Spanish Government, European Community and private companies. In 2012, he received the SEMNI Best PhD Thesis Award.

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