**Proceedings of the Canadian Society for Mechanical Engineering International Congress 2022**
**CSME Congress 2022**
**June 5-8, 2022, Edmonton, AB, Canada**

# Thermomechanical response of a cracked functional viscoelastic-piezoelectric strip

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ABSTRACT

Bone exhibits a remarkable combination of high stiffness, high strength and light weight due to its brick-and-mortar like structure composed of hard hydroxyapatite crystals and soft collagen matrix. The carbonated hydroxyapatite crystals are periodically deposit within the gap zones of collage. This hierarchical arrangement enables a mechanism for high energy dissipation and resistance to fracture. Particularly, once collagen undergoes fracture, the mechanical strain generates electric fields in the collagen and shows piezoelectric properties. Furthermore, a viscoelastic time-dependent characteristics also exhibits in bone. Inspired from its hierarchical structure and functional, piezoelectric time-dependent properties, a viscoelastic-piezoelectric model is built to evaluate its cracked mechanical behaviour. At the sametime, the bone cells are highly sensitive to their environment, therefore thermal disturbance and mechanical loading are considered in our work. With the aids of non-Fourier heat conduction model and Laplace transform, the thermal-viscoelastic piezoelectric problem is converted into a system of singular integral equations with Cauchy kernels of the first kind and then solved numerically. The parametric study is performed and the numerical results of temperature response, electric displacement and stress intensity factors around the crack tips, are shown graphically to illustrate the effect of thermal disturbance and mechanical load on the thermoviscoelastic, piezoelectric response.

Word count: 201