A fractional approach to non-local thermoelasticity

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In recent years fractional differential calculus applications have been developed in physics, chemistry as well as in engineering fields. Fractional order integrals and derivatives extend the well-known definitions of integer-order primitives and derivatives of the ordinary differential calculus to real-order operators.
Engineering applications of these concepts dealt with viscoelastic models, stochastic dynamics as well as with the, recently developed, fractional-order thermoelasticity [3]. In these fields the main use of fractional operators has been concerned with the interpolation between the heat flux and its time-rate of change, that is related to the well-known *second sound* effect. In other recent studies [2] a fractional, non-local thermoelastic model has been proposed as a particular case of the non-local, integral, thermoelasticity introduced at the mid of the seventies [1].
Very recenlty the autors provided a physical description of fractional, non-local effects for heat transfer in a rigid body introducing the long-range heat flux and, on this basis, a modified version of the Fourier heat flux equation is obtained. Such an equation involves spatial Marchaud fractional derivatives of the temperature field as well as Riemann-Liouville fractional derivatives of the heat flux with respect to time variable to account for *second sound* effects [4].
In this study the authors aim to extend the non-local model of fractional heat conduction to the case of of a purely elastic material accounting for the thermoelastic coupling. Some numerical examples will be also discussed to show the effects of a non-local heat transfer in the stress distribution occuring in an 1D solid domain.

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