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TIME-FRACTIONAL MECHANICS FOR SOFT TISSUE MODELLING

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In this work a damage mechanical model for soft tissue is presented. The numerical examples will cover the aorta and brain (white matter) case studied. The central point of the proposed approach lies in the evolution law for damage variable that is formulated with the application of fractional calculus. Such a concept of fractional damage velocity provides physical interpretation, that damage evolution includes memory (cf. Fig. 1).

This new formulation introduces two additional material parameters compared with classical formulations: (i) order of damage evolution (velocity); and (ii) memory (time length scale) of damage evolution. Both parameters allow very flexible modelling of material softening observed in the experiment. Special attention will be devoted to the appropriate definition of fractional derivative which has a potential to extract hidden aspects of real world phenomena – in our case complex behaviour of biomaterials.

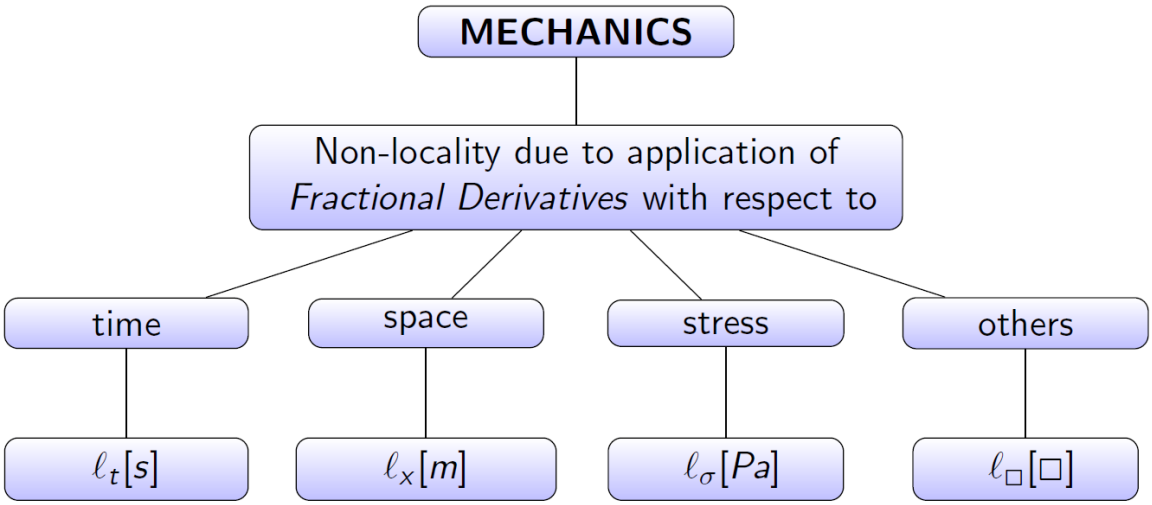

Fig. 1 Possible non-localities in mechanics due to application of fractional derivative operator

REFERENCES

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