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Editorial Open Access

New Methodology for Monitoring of Bone Fracture Healing

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Editorial

As presented in [1] damping plays an important role in technical practice, while according to [2] it is important for many load types. For each material there are many mechanisms [2] generating damping regardless of material type.

Degradation of structural integrity of materials is related to strength decrease. Evaluation of defects effect on materials strength is very important consideration in engineering technology. The origin of these defects may be fatigue or static loading and their presence influences the behavior of a material towards mechanical stresses.

The presence of a defect (i.e. crack) in a structural member according to [3] introduces a local flexibility affecting its vibration response. Hence, damping is a very important material property in vibrating structures made out of materials facing crack development.

From all damping mechanisms thermodynamic damping has been shown to be an important alternative in structural integrity assessment through dynamic evaluation of defective structures [4,5].

The thermodynamic theory of damping was used in [5] to find material and system damping due to change in crack depth in a homogeneous, isotropic, elastic bar with propagating fracture. In this work it was shown that this damping category accounts only for the specific structural defect and can be used as indicator of crack severity on conventional materials.

The case of fractured bones, which from the mechanical point of view are considered as composites, may be treated through bone structural assessment by thermodynamic damping analysis and measurement. This target requires the following:

- Analytical formulation of thermodynamic damping changes due to changes in crack propagation, simulating the fractured bone architecture.
- Design and construction of dedicated devices for damping measurements on bones to be used for testing, in comparison to measurements acquired with existing conventional methods.

As alternative means of bone structural integrity identification, diagnosis and monitoring of bone fracture healing.

Conclusion

The technique's envelop of the topic includes a rigid thermodynamic damping theory supported by analytical and experimental tools for damping calculation and measurement. Series of thermodynamic damping applications, analytical and experimental, have been presented in literature exploring the effect of material defects on structural thermodynamic damping.

In the frame of the developed thermodynamic technique the analytical work was restricted on structures of ideal shapes. However, given that damping is a material and system property, structures of any shape may be modeled accordingly in order to be tested. Hence, bone holistic modeling, in combination to design and development of suitable measuring system, would lead to accurate and competitive means for bone quality assessment. Such a research approach would bring up unanswered theoretical issues, which need to be solved.

The challenge occurring is the development of methodology based on thermodynamic damping theory for monitoring bone fracture healing.

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