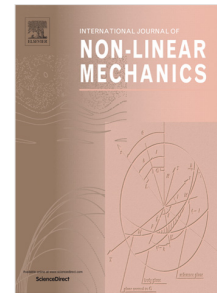


## Accepted Manuscript

The complex mechanical response of anisotropic materials in simple experiments

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PII: S0020-7462(18)30025-8

DOI: <https://doi.org/10.1016/j.ijnonlinmec.2018.05.025>

Reference: NLM 3033

To appear in: *International Journal of Non-Linear Mechanics*

Received date: 11 January 2018

Revised date: 22 May 2018

Accepted date: 29 May 2018

Please cite this article as: C.O. Horgan, J.G. Murphy, G. Saccomandi, The complex mechanical response of anisotropic materials in simple experiments, *International Journal of Non-Linear Mechanics* (2018), <https://doi.org/10.1016/j.ijnonlinmec.2018.05.025>

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1 The complex mechanical response of anisotropic  
2 materials in simple experiments

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5 **Abstract**

6 The classical stress-strain law for linear incompressible transversely isotropic  
7 materials is inverted to obtain the infinitesimal strain as a function of the stress.  
8 This relation is then used to obtain the strain response for two stress controlled  
9 material characterisation tests, namely simple shear and simple tension. These  
10 tests typically constitute the experimental basis of constitutive modelling in biome-  
11 chanics. It is shown that the strain response for transversely isotropic materials is  
12 radically different from that exhibited by isotropic materials. Specifically it is shown  
13 that the strain response is fully six-dimensional for both experiments and that the  
14 new strain components arising as a result of anisotropy can be significant when  
15 compared to the strains that are characteristic of isotropic materials. It is antici-  
16 pated that this complexity will be amplified in non-linear models. It is also shown  
17 that there are orientations of the preferred direction for which a quasi-isotropic  
18 response is possible, a so-called magic angle effect.

19 *Keywords: strain response; inversion; transverse isotropy; magic angle.*

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