MASTER THESIS

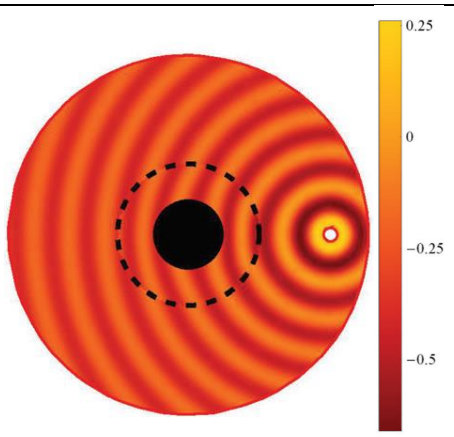
NUMERICAL AND EXPERIMENTAL STUDY OF WAVE PROPAGATION IN PRE-STRESSED MEDIA

Context:

Steering waves in elastic solids, i.e., steering “phonons”, is more demanding than steering waves in electromagnetism or acoustics. As a result, designing material distributions that are the counterpart of optical invisibility cloaks in elasticity poses a major challenge: Waves of all polarizations have to be guided around an obstacle to emerge on the downstream side as though no obstacle was there. Recently, Parnel [1-2] introduced the idea of self design cloaking systems by pre-stress. This simple and explicit construction procedure led to very good cloaking results using Neo-houkean hyperelastic materials.

Goal:

Here in the project we want to design, fabricate and characterize cloaking and lensing devices using the idea of William Parnel on pre-stressed media. Two main task are devoted to the project. A first step will focus on the numerical design of structure for cloaking and lensing. In a second step we will work on the experimental implementation and dynamic testing. Altogether the project will be done in collaboration between an industrial partner (Paulstra-Hutshinson) and 3 academic teams (FEMTO ST, LAUM and University of Manchester). We aim at showing an real interest in noise reduction and focusing for industrial applications.



References :

[1] W. J. Parnell. Nonlinear pre-stress for cloaking from antiplane elastic waves. Proc. R. Soc. A, 468, 563–580, 2012.

[2] W. J. Parnell, A. N. Norris, A. N. and T. Shearer, Employing pre-stress to generate Finite cloaks for antiplane elastic waves. Appl. Phys. Lett. Appl. Phys. Lett. 100, 171907 2012.

Starting possibly from : 01/01/2017

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