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Acoustic Localisation of Coronary Artery Stenosis: Towards a Proof-of-Concept

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Plaque build-up in a coronary artery causes blood flow past the stenosed region to become turbulent. This drives low amplitude acoustic shear waves through the soft tissue in the thorax to the chest wall, where they can be measured. This acoustic surface signature can potentially provide a cheap non-invasive means of diagnosing a stenosis. A three-part interdisciplinary "proof-of-concept" project, for a phantom of tissue mimicking (viscoelastic) agarose gel, consists of:
1. Computational modelling, 2. Measurement of material and acoustic properties, 3. Solution of an inverse problem to locate the stenosis.

Here we describe Part 1: Finite element modelling of the primary problem, where shear waves from a source in the phantom reach the (chest) boundary. Axial symmetry is assumed giving a 2D space-time viscodynamic (Zener, Kelvin-Voigt model) wave problem in a phantom cross-section. Numerical methods and results are given and compared with those of experiment. A companion talk describes Part 2.

Keywords: Stenoses, Acoustic shear waves**,** Computational modeling, Viscoelasticity, Finite elements