FDRG Seminar

Modelling waves in the spinal canal

presented by

Dr Novak Elliott
Fluid Dynamics Research Group,
Curtin University

This is a two part presentation on the following (closely related) topics.

THE DEVELOPMENT OF MATHEMATICAL MODELS ACCESSIBLE TO CLINICIANS

Physical scientists work with clinicians on biomechanical problems, yet the predictive capabilities of mathematical models often remain elusive to clinical collaborators. This is due to both conceptual differences in the research methodologies of each discipline, and the perceived complexity of even simple models. This limits expert medical input, affecting the applicability of the results. Moreover, a lack of understanding undermines the medical practitioner's confidence in modeling predictions, hampering its clinical application. In this talk we consider the disease syringomyelia, which involves the fluid-structure interaction of pressure vessels and pipes, as a paradigm of the nexus between the modeling approaches of physical scientists and clinicians. The observations made are broadly applicable to cross-disciplinary research between engineers and non-technical specialists, such as may occur in academic-industrial collaborations.

THE FLUID-STRUCTURE INTERACTIONS OF A CEREBROSPINAL WAVEGUIDE

In the disease syringomyelia, fluid-filled cavities, called syrinxes, form in the spinal cord. The expansion of these pathological pressure vessels compresses the surrounding nerve fibers and blood supply, which is associated with neurological damage. We investigate the spinal wave-propagation characteristics, principally to serve as a reference for more anatomically-detailed models. The spinal cord is modeled as an elastic cylinder, which becomes an annulus containing inviscid fluid when a syrinx is included. This is surrounded by an annulus of inviscid fluid, representing the cerebrospinal fluid occupying the subarachnoid space, with an outer rigid boundary approximating the dura mater. The axisymmetric harmonic motion is solved as an eigenvalue problem.
We present dispersion diagrams and describe the physical mechanism of each wave mode. We identify potentially damaging syrinx fluid motions and tissue stress concentrations from the eigenvectors. Finally, we determine the dependence of each wave mode on syrinx radius and cord tissue compressibility.

Date:	Thursday 14th August
Time:	4pm – 5pm
Location:	216:203
	Curtin University, Bentley Campus

No RSVP required. For queries please email:
fdrg@curtin.edu.au