**Ultrasonic Transduction course - Design assignments**

Each group will receive a different coordinates and size of the defect to optimize for. Having the specification of the defect, complete the following assignments:

**Assignment 1: Design a single-element immersion probe, optimized for the given defect specification**

Employing the analytical modelling approach only, design a piezoelectric transducer suited to immersion testing.

The design should comprise a ceramic monolith as the active element, appropriate matching and backing layers for operation into a water load.

The proposed design must be accompanied with full justification of each component that comprises the final transducer, in particular:

* Selection of both active and passive materials,
* Appropriate plots of transducer performance in the time and frequency domain to justify each component of the design,
* Analysis of pulse length, bandwidth and sensitivity of the proposed design

**Assignment 2: Design a contact linear phased array, optimized for the given defect specification**

Employing a combination of analytical, simplified numerical, and finite modelling, present a linear array design for contact testing of a steel specimen.

The design should comprise a piezoelectric composite as the active element, and appropriate matching and backing layers.

The proposed design must be accompanied with full justification of each component that comprises the final array design:

* Selection of the ceramic and passive polymer material;
* Design of the ceramic volume fraction;
* Design of the array geometry
* Design of any ancillary backing and matching layers;

You must include appropriate performance plots, in particular:

* Transducer performance in the time and frequency domain
* The beam steering capabilities of the design
* Analysis of the inter-element cross-talk of the array, and if applicable, effect of measures implemented to mitigate for same.
* A-scan performance of the array on a side-drilled-hole defect

**Finally,**

Prepare a set of PowerPoint slides for 10-12 minute presentation where you will pitch your designs for critique.