

EPSRC HiFFUT Fellowship Project Kick-Off Meeting Minutes

Date of Meeting: 12 December 2016

Location of Meeting: Department of Physics, University of Warwick

Present: Colin Edge^{CE} (DynOptic Systems), Noel Kerr^{NK} (EES Research), Daniel Fratzscher^{DF} (FLEXIM), Andy Hammond^{AH} (FLEXIM), Rob Turner^{RT} (Katronic), Tom Bennett^{TB} (NNL), Steve Dixon^{SD} (University of Warwick), Andrew Feeney^{AF} (University of Warwick)

13 December 2016

Dear project partners,

Thank you for your attendance at the meeting, I hope you found it both informative and useful. The key points from the meeting are summarised below.

- Each project partner gave a brief summary of their company and what they do.
- AF gave a presentation on the research programme, introductory material to the HiFFUT technology, and the design work which has been conducted so far.
- A general discussion of the work packages and key deliverables followed.
 - RT asked if the HiFFUT could be coupled to a solid. SD explained the challenge of doing so and how directly coupling could degrade performance, by restricting the ability to flex, but that coupling via a liquid means that it could be used in immersion testing.
 - NK asked if we had considered using square membranes. SD and AF explained how we have not yet, but could do and why focus has been placed on cylindrical axisymmetric membranes so far. There needs to be an application to drive the change in design so that should be explored. There was also a suggestion to try using non-metallic membranes, which might be useful when using the transducer in an explosive atmosphere. There may be significant restrictions due to explosion prevention laws, even if the membrane is on ground potential.
 - NK asked about ultrasonic spectroscopy given the sensor could have multiple frequencies of measurement. NK also discussed potential use in silo measurements looking at surface profile and level, and asked if SD and AF had considered using the sensors to detect bubbles in clay slurry used in producing porcelain. It was noted that this was a good idea and it would be useful to see if anyone had any suitable applications. There are a few

ways that profile could be tackled once the sensor design has been redefined.

- NK asked if it would be possible to incorporate active damping in some designs of HiFFUT using something like ferrofluids. It was noted that this was a good idea and that this should be revisited once a design of the EMAT driven sensor at the prototype stage is produced.
- CE said that he would be interested in seeing if the sensors could operate at approximately 200 Hz over a short path of around 100 mm.
- DF suggested using more than one active element in the transducer design.
- TB said that radiation hardness is of key interest for the potential application areas of interest to NNL. Also, immersion testing of spent fuel pins is of interest for wall thickness measurement, with a discussion of the inclusion of solid particles in a liquid, potentially with some sizing capability. Radiation hardness is yet unknown. There will be important design considerations for this, given that the transducer epoxy used will not normally be radiation hard. However, direct bonding of the piezo element may be possible. It was also discussed how using low frequency guided waves might in principle enable one to measure wall thickness.
- NK asked if SD and AF needed anything from the industry collaborators such as electronics for driving the sensors or access to applications. SD and AF felt that this was a really good idea and invited any of the partners to provide any electronic system performance that they would like to test. SD and AF will also provide sample sensors to the partners in due course.
- NK asked if there were any issues regarding discussion outside of meetings. SD said that there was not as far as the work of the University of Warwick is concerned. However, all were asked if they wanted to have an NDA that covered discussions in the project meetings, and they were reminded that NDAs and private discussions could be held outside the regular project meeting if required. It is anticipated that the research presented by the University of Warwick will be pre-competitive and freely disseminated.
- SD asked how often meetings were required - every 3 or 6 months. The consensus was that meeting should be held once every 3 months, where project partners could join by teleconferencing if they cannot attend in person.
- AF asked about correspondence and dissemination of information. It was agreed that a regular update, such as a short report, can be issued to project partners. A report could be made available either on a monthly

basis to project partners, as was discussed in the meeting, or whenever there is a significant development in the project or research.

- The meeting concluded with a tour of CIU facilities.

Actions

1. Date of next meeting to be decided. The University of Warwick will organise these meetings, and check what system can be used for teleconferencing, as NNL cannot use video conferencing.
2. AF will contact all project partners for details and approval for including confirmation of permission, company logos, descriptions and contact details for their organisations on the website.
3. Project partners to identify and send any electronics that they think might be useful or interesting to try driving the sensors that already exist in the CIU.
4. The University of Warwick to send prototype sensors to project partners as required, when new units have been constructed.

I hope everyone has an enjoyable festive period.

Andrew

Dr Andrew Feeney
Research Fellow, Centre for Industrial Ultrasonics