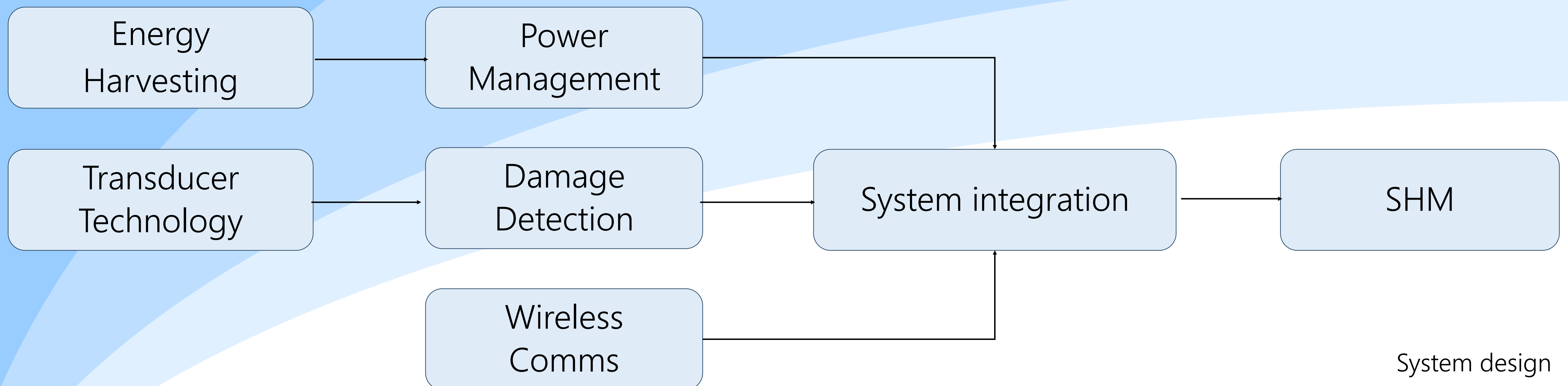# Energy Harvesting for Structural Health Monitoring

MONTAGU - an Innovate UK project

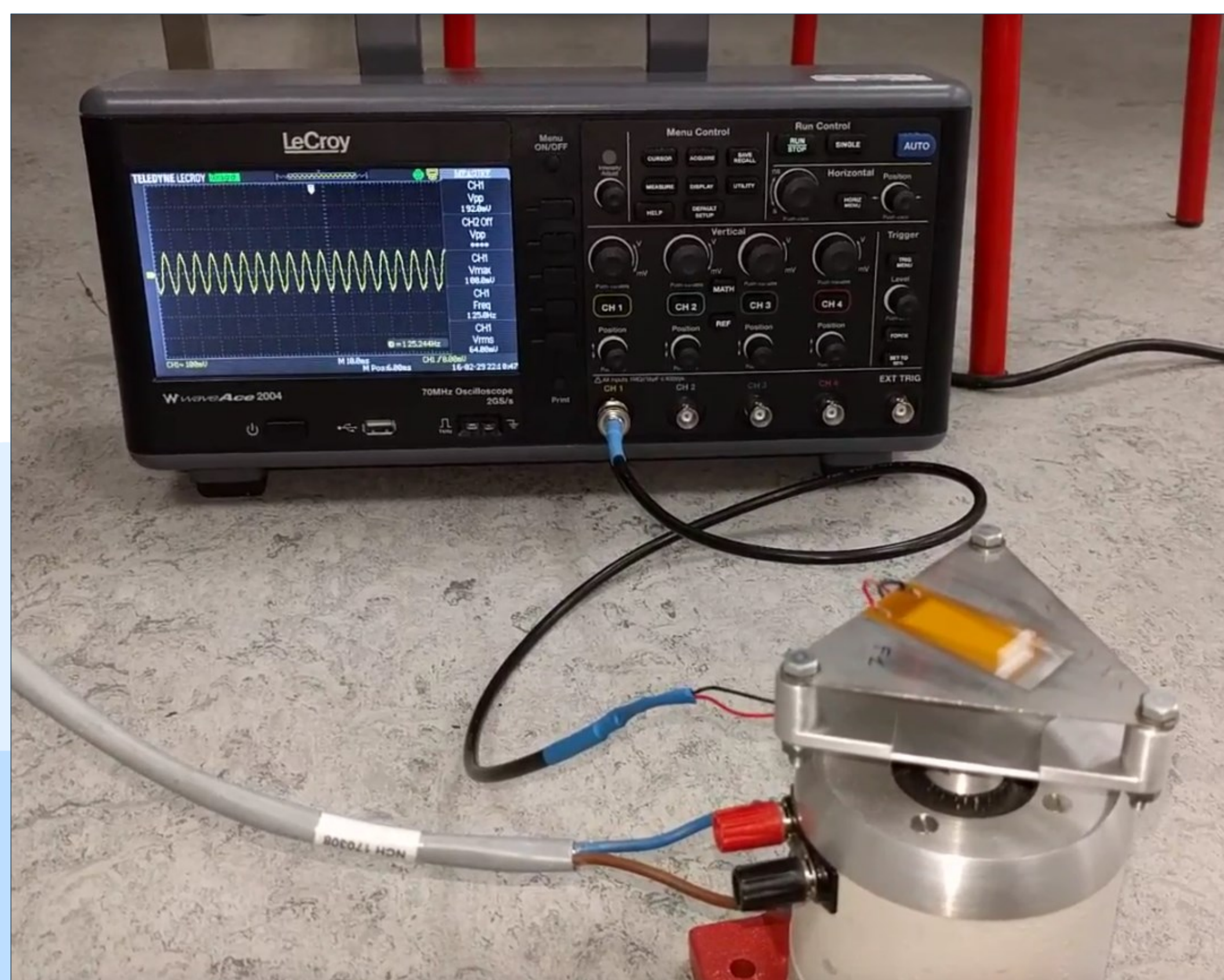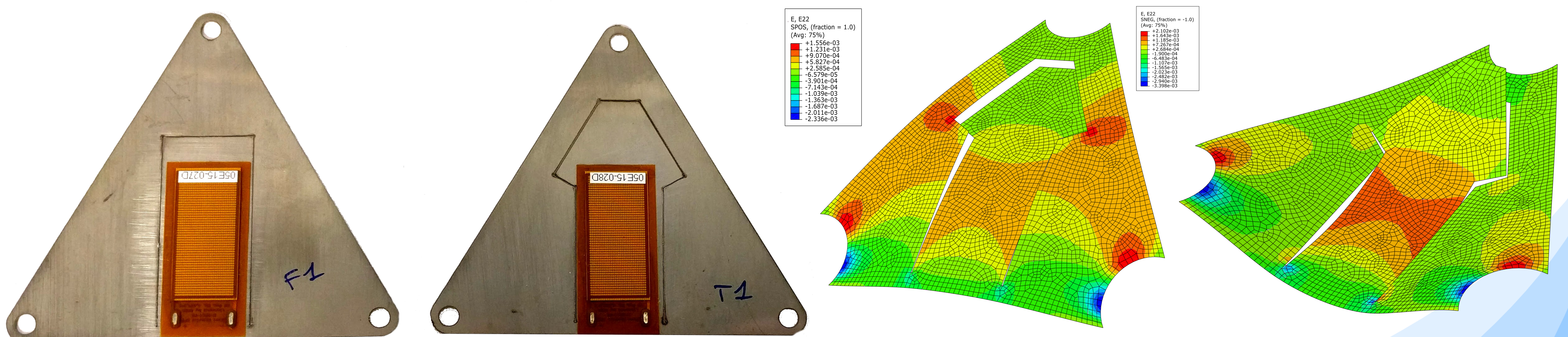Rhys Pullin, Davide Crivelli, Carol A Featherston

Cardiff University, School of Engineering
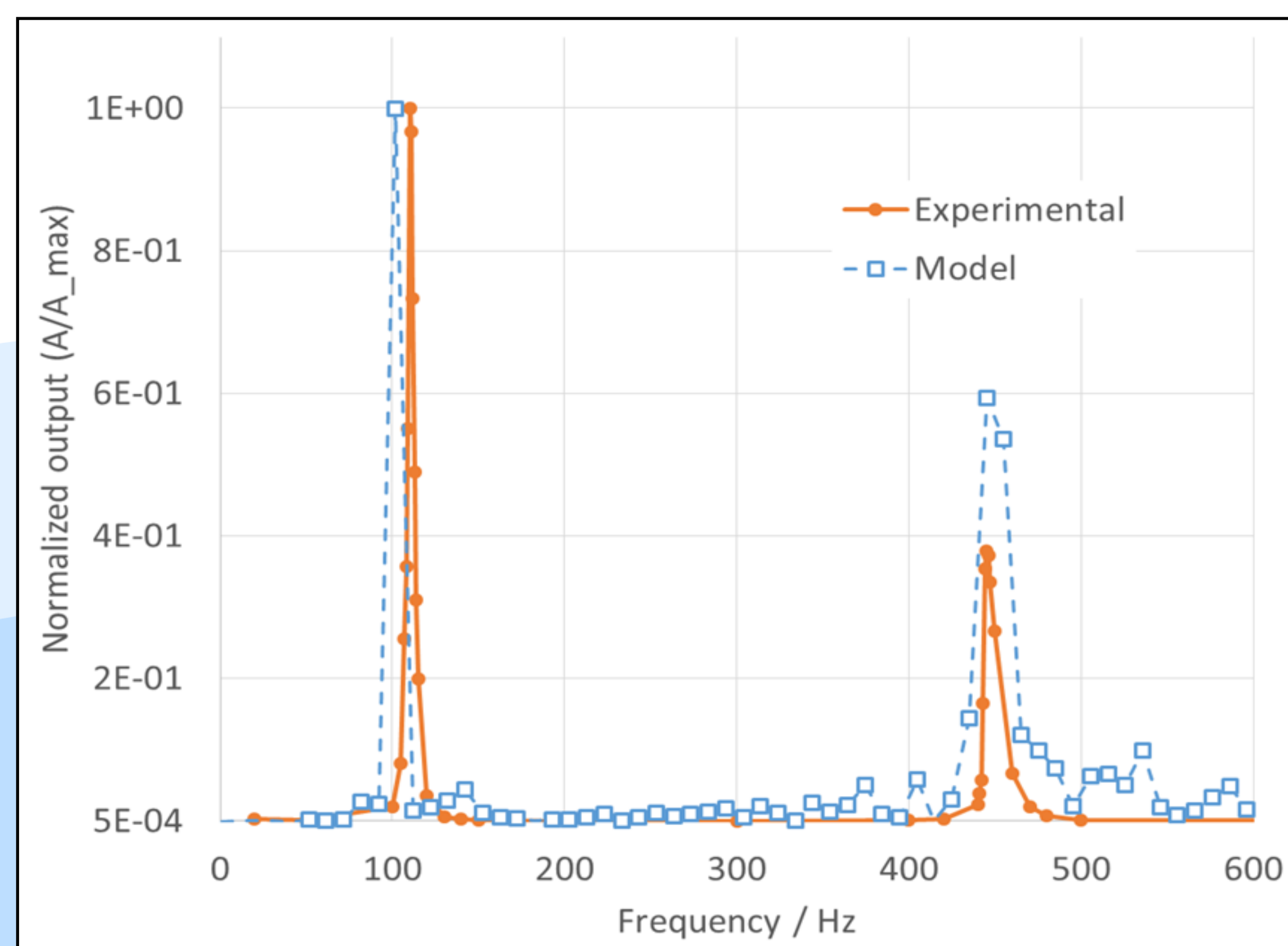
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The MONTAGU Innovate UK project is developing an optimised, integrated power supply which will take energy scavenged during normal aircraft flight conditions to power an autonomous **Structural Health Monitoring** (SHM) system to locate and monitor damage. Harvesting techniques such as **thermoelectric** energy harvesting have been shown to be capable of delivering the magnitudes of power necessary to operate a low power SHM system based on Acoustic Emission (AE). Other techniques such as **vibration** harvesting have the potential to supplement this during times where thermal gradients are too low to generate the required power.

Energy Harvesting	→	Power Management
Transducer Technology	→	Damage Detection	→	System integration	→	SHM
		Wireless Comms

System design

A system capable of harvesting power through **tuned vibration harvesters** and **thermal gradient generators** is being designed. The vibration harvesting component consists of a piezoelectric energy harvesting unit based on macro-fibre composite (MFC) actuators/ generators. A set of Finite Elements models have been developed to assess the performance of different energy harvester configurations. These models have been validated experimentally using a shaker to vibrate a range of harvesters .

Harvester configurations

Longitudinal strain field at first two natural frequencies

Experimental set-up

Comparison of power levels—experimental and FE

FE modelling demonstrated **good correlation** with the experimental data for the first two vibration modes, although the third natural frequency is offset and further investigate is being carried out to determine the reasons for this. Testing showed that voltage levels **grow linearly** with g levels.

The storage and supply unit designed through the project will be capable of accepting **different power sources** as inputs, **storing** it during periods of excess production and **delivering** it during periods of excessive demand. This will accommodate most phases of aircraft taxi and flight, to allow the SHM system to detect any **damage or impacts** occurring during these phases.