**PhD Project Proposal**

School of Electronics, Electrical Engineering and Computer Science

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| **Proposed Project Title:** Virtual-Acoustic Musical Instrument Design |
| **Principal Supervisor: Dr Maarten van Walstijn Second Supervisor: Prof Paul Stapleton (AEL)** |
| **Project Description:**  A virtual-acoustic approach to digital musical instrument (DMI) design aims for acoustic sounding output and providing a natural alignment between control parameters and performer actions. Physical modelling is a good match for this purpose in terms of designing the sound synthesis algorithm, and involves applying numerical methods to mechano-acoustic problems under the specific constraints of music and audio applications. This interdisciplinary project is focused on the design of a novel virtual-acoustic instrument based on the simulation of plates and membranes, and will be highly configurable through adjusting parameters of both the model and the interface, as such allowing precise control of the instrument affordances. The instrument is intended as a tool for both music performance and experimental investigation into how musicians learn and discover new techniques on computer-based instruments. In addition, its development will inform ongoing research that aims to enhance the interactive audio aspects of virtual and augmented reality systems and applications.  The primary challenges that the project aims to address are (1) the development and real-time implementation of a finite-difference plate/membrane model that affords local damping control, (2) the design and realisation of a configurable mapping of high-resolution touch-sensitive screen and other sensor data to the plate model grid, and (3) the evaluation of the instrument through the use in the professional practice of musicians as well as through psychology-based experiments. The student will be based at the based at the Sonic Arts Research Centre, and work closely with the supervisory team who have specialist knowledge in audio engineering, interaction design, and ecological psychology as well as with expert musicians in the testing and experimentation phases of the research.  Student Profile: The candidate needs to have an engineering/science background that includes experience in computer programming, as well as an appreciation of the unique demands of music performance. Knowledge of acoustics and signal processing as well as previous experience in experimental psychology and in interdisciplinary research projects are highly desirable but not necessary. |
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