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Using a Haptic Driver for an Ultrasonic Tactile Interface

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***Abstract*— This demo presents several ultrasonic haptic surfaces which use a commercial haptic driver to generate the required amount of voltage, and to produce the haptic feedback. It is based on a specific design of the high frequency DC to AC converter. With this topology, it is not necessary to develop haptic drivers specifically for haptic surfaces. In our implementation, we use a Boréas dev kit, and the haptic surface is therefore controlled through the sound controller of a laptop PC.**

Keywords—Power management, haptic surface, friction reduction

I. Introduction

Haptic surfaces based on active lubrication generate ultrasonic vibrations of a glass plate [1]. They require high frequency and high amplitude voltage to operate. As a result, specific DC to AC drivers need to be develop. Commercial products exist, which can boost the voltage to a sufficient level. They often include a haptic layer which is able to communicate to a laptop computer through USB connection for instance. However, these products are designed only for vibrotactile applications, and they have a limited bandwidth far below the ultrasonic frequencies.

It is however possible to use them if their output is connected to the DC BUS of the high frequency DC/AC converter of a haptic surface [1]. The main advantage is that it becomes possible to use a same chip to control the haptic feedback and produce the high voltage signal. This has several adavantages for introducing more haptic surfaces into consumer products: Developpers of haptic contents can develop with the same tools, and same environment, for vibrotactile applications and/or surface haptics. Manufacturers of haptic surfaces don't have to develop haptic drivers for their products; chip makers have larger market for their controllers. These advantages save cost and time in haptic product developments.

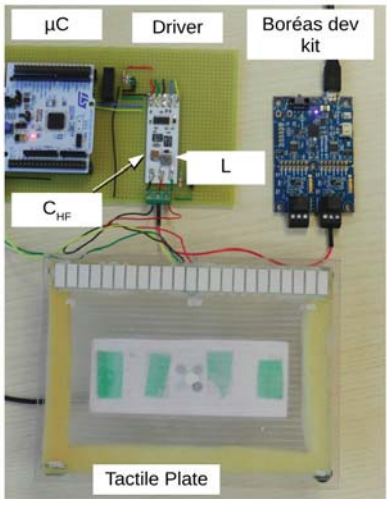
II. Demo

The Objectives of the demo is to make people understand that a same chip can control a piezoelectric vibrotactile actuator and an ultrasonic haptic surface. For that purpose, we have 4 components:

- A commercial Boreas Dev kit with its haptic actuator [3]
- Two ultrasonic haptic surfaces
- A laptop computer.

In a first experiment, the participant experiences a piezoelectric vibrotactile actuator. He can control the frequency and the amplitude of the stimulation thanks to an interface programmed in Matlab or python.

After testing the vibrotactile device, the operator unplug the vibrotactile actuator, and plugs, on the same haptic controller, the driver of a large area haptic surface. The participant can then again, on the same interface, control the frequency and amplitude of the stimulation. The power supplied to the haptic surface is provided by the Boréas dev kit, which can also play a stored haptic stimulus. For the viewpoint of the Boréas chip, the haptic surface is analogous to a capacitor.



A small haptic surface is then connected to the Boréas Dev kit, through its DC/AC converter to again show how versatile the solution is.

After the demo, which requires 5 minutes, the participant can initiate a discussion with the operator..

[1] *Basdogan, Cagatay, et al. "A review of surface haptics: Enabling tactile effects on touch surfaces." IEEE transactions on haptics 13.3 (2020): 450-470.*

[2] *Anis Kaci, Frédéric Giraud. Driver Design for Practical Implementation of the Haptic Feedback with Ultrasonic Surface. University of Lille. 2024. ⟨hal-04632431⟩*

[3] *https://www.boreas.ca*