# Can we create life-like sensations with electrical stimulations?

**This project implies that it is possible to generate and adapt the sensations that appear in the hand when stimulating its nerves by changing the pulse used. This could make it possible for an amputee to feel tingling, tapping or buzzing when their prosthetic hand senses its surroundings and restore some of their sense of touch.**

The human hands are a wonder of nature's engineering. They can crush an egg without problem or carry one's entire weight yet also create the most detailed works of art. We use them to perform endless tasks every day and this is what makes the loss of a hand so debilitating and the replacement so important. Prosthetics have come a long way from the hook of Captain Hook or Jamie Lannister's golden hand but still have a long way to go before they can do all the things a hand can do. One of the major things that today's prosthetic hands lack is the sense of touch. Using an array of sensors, the prosthetic can record all kinds of information but there is still no great way for the user to receive the information.

One promising method is using transcutaneous electrical nerve stimulation (TENS) to generate life-like sensations in the hand. This thesis investigated just that. It investigated how changing the properties of the electrical pulses generated different sensations, how natural the sensations felt and where in or on the hand they appeared. After a bunch of testing, it was clear that it is possible to create sensations in the hand that feel very close to sensations we would experience in our everyday life. Sensations like the tingling that appears when something lightly strokes you finger, the buzzing from holding you vibrating phone, and more were easily created. By just stimulating one of the nerves that lead to the hand sensations appeared in almost the entire palm and using the other two nerves the rest of the hand could also be covered. The different properties of the electrical pulse seem to affect the resulting feeling in different ways which implies that the pulses could be adapted to create different sensations by changing the pulse. It shows that this method is very promising and could be a great alternative for providing a wide array of sensory feedback to prosthesis users of all kinds.

If further research into the method and the effect of the pulses parameters shows similar patterns this could potentially allow for amputees all over the world to once again do a variety of activities and tasks that today would be impossible without assistance or constantly looking at every move they make to. It could greatly improve their life quality and give back a sense of independence.