

ADDRESSING MOTOR DISABILITIES WITH FUNCTIONAL ELECTRICAL STIMULATION

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1 Presentation



Figure 1: FES in action at the 2017 Cybathlon in Zürich.

Functional Electrical Stimulation (FES) is a method that uses weak electric fields to trigger action potentials, which provoke nerve impulses leading to muscle contractions. When contractions are properly sequenced, the muscle activity can produce movement which has functional outcomes such as; standing, ambulation, grasp-to-reach and other practical movements. This method is particularly useful to actuate paretic muscles in the physically disabled, allowing them to gain autonomy and improve their health through participation to physical activities. We investigate both fundamental aspects of how electromagnetic fields generate muscle contractions and practical features of how these fields can be used to optimize functional electrical stimulation devices for paretic limbs, e.g. gloves for hand grasping and shorts for lower limb exercises (cycling, rowing and standing)). Open fundamental questions of interest concern the application of combined electrical and magnetic fields to improve stimulation efficiency. While practical challenges include the development of devices that are more user-friendly and that can be used in daily activities, for example using EMG triggering systems in conjunction with FES activities.

2 Bio of Vance Bergeron

Dr. Vance Bergeron, born in the United States on October 12, 1962 in Hampton, Virginia, is married and father of two children. He received his Bachelor of Science degree in Chemical Engineering from Virginia Tech followed by a PhD from the University of California Berkeley. Subsequently, in 1993 he was awarded a Chateaubriand fellowship to study in the Laboratoire de Physique at the Ecole Normale Supérieure, Paris, France and a Swedish Institute fellowship at the Royal Institute in Stockholm, Sweden. Following this period, he worked as a senior research scientist at the chemical company Rhône Poulenc for 5 years, and was later appointed to the French national research laboratories, (Centre National de la Recherche Scientifique, CNRS) in the year 2000. He is now a CNRS Research Director in the physics laboratory at the Ecole Normale Supérieure, Lyon.

Dr. Bergeron has authored over 50 patents and 150 scientific review papers in the fields of, chemistry, physics, indoor air quality and neurorehabilitation. Following a bicycle accident while riding to work on February 7, 2013, Vance Bergeron was left C6/C7 tetraplegic. This resulted in changing his focus to a translational research approach, incorporating an international team, to develop new neurorehabilitation therapies and sports.