



CCEC Seminars Presents Sensory Motor Instability and Central Pattern Generator in Spinal Oscillations

with
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Abstract:

An electrophysiological phenomenon running along the spine, referred to as Network Spinal Analysis (NSA) wave, is analyzed from the point of view that it is created by a sensory-motor loop instability, itself settling in a central pattern generator.

The major investigative tool is surface electromyographic (sEMG) signal analysis at various points along the paraspinal muscles. The sEMG signals appear to consist of a great many "bursts," hinting at a global synchronization of the firing of the spinal neurons. Statistical correlation among the various points along the spine is used to identify the propagation delay of the bursts from one point to another along the spine and hence to establish the traveling wave phenomenon, itself settling in a stationary wave phenomenon on a specific subband of the Daubechies wavelet decomposition of the signals. As such, the spine is viewed as a propagation medium, with the sensory-motor loops at the cervical and sacral areas providing boundary conditions on which the wave reflects. As a therapeutic application, it is shown that partial recovery from spinal cord injury can be assessed by the correlation between the sEMG signals on both sides of the injury.

More fundamentally, for a quadriplegic subject who has had some recovery, the wave appears to travel through the injury area, but does not quite settle in a stationary pattern as it would be in a normal subject. The same quadriplegic patient analysis reveals that the nervous pathways need not go via the brain, hence indicating the presence of a central pattern generator. .

About the Speaker:

Edmond A. Jonckheere was born in Belgium, in 1950. He received the Electrical Engineer degree from the Universite de Louvain, Louvain-la-Neuve, Belgium, in 1973; the Doctor in Engineering degree in Aerospace Engineering from the Universite Paul Sabatier, Toulouse, France, in 1975; and the Ph.D. degree in Electrical Engineering from the University of Southern California, Los Angeles, in 1978.

From 1973 to 1975, he was with the Laboratoire d'Analyse et d'Architecture des Systemes, Toulouse, France, as a Research Fellow of the European Space Agency. From 1975 to 1978, he was a Fulbright/Hays Fellow and a Teaching and Research Assistant in the Department of Electrical Engineering--Systems and subsequently a Research Associate in the same department. From 1978 to 1979 he was with the Royal Military Academy, Brussels, Belgium. From 1979 to 1980, he was with the Philips Research Laboratory, Brussels, Belgium. In 1980, he returned to the University of Southern California, where he is currently a Full Professor of Electrical Engineering and Mathematics, an Associate Member of the Center for Applied Mathematical Sciences (CAMS), and a member of the newly established Center for Computer Systems Security (CCSS) of the Information Sciences Institute (ISI) of the University of Southern California.