

Review and Analysis of Parkinson's Tremor Genesis Using Mathematical Model

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Abstract : Parkinson's Disease (PD) is a long-term neurodegenerative movement disorder of the central nervous system with vast symptoms related to the motor system. The common symptoms of PD are tremor, rigidity, bradykinesia/akinesia, and postural instability, but the clinical symptom includes other motor and non-motor issues. The motor symptoms of the disease are consequence of death of the neurons in a region of the midbrain known as substantia nigra pars compacta, leading to decreased level of a neurotransmitter known as dopamine. The cause of this neuron death is not clearly known but involves formation of Lewy bodies, an abnormal aggregation or clumping of the protein alpha-synuclein in the neurons. Unfortunately, there is no cure for PD, and the management of this disease is challenging. Therefore, it is critical for a patient to be diagnosed at early stages. A limited choice of drugs is available to improve the symptoms, but those become less and less effective over time. Apart from that, with rapid growth in the field of science and technology, other methods such as multi-area brain stimulation are used to treat patients. In order to develop advanced techniques and to support drug development for treating PD patients, an accurate mathematical model is needed to explain the underlying relationship of dopamine secretion in the brain with the hand tremors. There has been a lot of effort in the past few decades on modeling PD tremors and treatment effects from a computational point of view. These models can effectively save time as well as the cost of drug development for the pharmaceutical industry and be helpful for selecting appropriate treatment mechanisms among all possible options. In this review paper, an effort is made to investigate studies on PD modeling and analysis and to highlight some of the key advances in the field over the past centuries with discussion on the current challenges.

Keywords : Parkinson's disease, deep brain stimulation, tremor, modeling

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