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Improving human health: Challenges and methodology for controlling thermal doses during cancer therapeutic treatment

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Controlled thermal ablation in order to maximize the therapy and minimize the side effects poses a challenge during the heating of the biological tissue. Traditionally, these processes are modelled by the bio heat equation introduced by Pennes, who used the Fourier's theory of heat conduction. During my talk I will present our automated thermal dose control and prediction system for cancer tumors therapy by using Implantable Bio-chip solution. The proposed system is able to control thermal ablation doses deposition during a laser surgery/cancer treatment. A system would help physicians to predict thermal diffusion to organize the treatment as well as maximize therapeutic effects while minimizing side effects. An innovative approach is proposed to improve the quality of thermal treatments in oncology. A biochip platform will be investigated, designed, and prototyped on an FPGA board. The destruction of tumors using a heating source has been widely used as an efficient approach for cancer treatment, where the oncologists use a heating source to destroy the targeted tumoral tissue. A case study of the Laser Interstitial Thermal Therapy (LITT) will demonstrate his feasibility as Cancer therapeutic treatment.

Keywords: Real-time monitoring, Thermal ablation, BIOCHIP, Cancer tumor, FPGA, FDM, Laser Interstitial Thermal Therapy, Thermal damage, Brain cancer, Bio heat transfer simulation, Thermal sensor, Minimally invasive surgery, Robotic surgical assistants, Robotic arm.

Biography

Dr. Ahmed Lakhssassi received the B.Eng. and M.Sc. A in electrical engineering from Université du Québec à Trois-Rivières (UQTR), Québec, Canada in 1988 and 1990 respectively. He also received the Ph.D. in Energy and Material sciences in 1995 from INRS-Énergie et Matériaux (Institut National de la Recherche Scientifique), Québec, Canada. At the same year also, he had become a professor of Electro-thermo-mechanical aspects at NSERC -Hydro-Quebec Industrial Research Chair at Electrical Engineering Department of the UQTR, where, for several years, he conducted Electro-thermal research projects. Since 1998, he has been with UQO (Université du Québec en Outaouais), where he is currently titular professor and responsible of the LIMA laboratory (Avanced Microsystem Engineering Laboratory) developing IP core and embedded algorithms for microsystems thermo-mechanical sensors dedicated for thermal peak detection. His research interest is the fields of bio-heat thermal modeling such as: heat diffusion in biological tissues, metabolic heat generation and external interactions, heat transfer mechanism in biological tissues for thermal therapeutic practices including dedicated bio-implantable puce design for cancer thermal dose control. Furthermore, his research interest are in machine learning to recognize the type of pain and to quantify the amount of pain to tracks any potential injury using neural networks and thermal image processing. Also, his research interest is in Design of Fully Automated tool for Porting Analog and Mixed signal circuits within Different Technology nodes. Dr. Lakhssassi is senior member of IEEE. He is the author/co-author of more than 240 scientific publications and research report, and thesis advisor of 90 graduate and undergraduate students who completed their studies.

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