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Subject: Motivation Letter for Doctoral Researcher (f/m/d) Project B7 "Dynamics of electrical depolarization waves in the heart"

Dear Prof. Dr. Christian Wieners and the Selection Committee,

I am writing to express my strong interest in the Doctoral Researcher position for Project B7, "Dynamics of electrical depolarization waves in the heart," at CRC 1173. With a Master's degree in Numerical Analysis from the Institute for Advanced Studies in Basic Sciences (IASBS), Iran, I have developed a strong foundation in combining machine learning methodologies with traditional numerical techniques for solving partial differential equations (PDEs). The opportunity to contribute my expertise in numerical modeling and programming to the interdisciplinary challenges of simulating heart function within Project B7 is particularly compelling to me.

During my Master's studies, I worked extensively on numerical methods for solving PDEs with uncertainty, utilizing deep learning techniques. Initially motivated by challenges in biophysical modeling, I explored applications in breast deformation under compression, melanoma cancer modeling, and cellular growth simulations. While my thesis ultimately focused on developing a novel neural network approach for solving PDEs with domain uncertainties, these projects provided me with valuable experience in computational modeling and finite element methods—both of which are directly applicable to simulating depolarization waves and heart muscle contraction. Additionally, I implemented a custom periodic padding layer in TensorFlow/Keras to efficiently handle domain uncertainties, demonstrating my ability to develop innovative numerical techniques. Furthermore, presenting my research findings at the IASBS Student Presentations in English further solidified my communication skills in an academic setting.

Beyond my academic pursuits, my experience as a software developer helped me cultivate valuable teamwork, problem-solving, and time management skills. Collaborating within multidisciplinary teams to deliver projects under tight deadlines has honed my communication and adaptability. This period of professional software development, undertaken alongside personal responsibilities including caring for my elderly father, broadened my skillset and reinforced my dedication to focused, impactful work. With my family situation now stabilized and with renewed energy, I am eager to fully dedicate myself to research and return to my academic passion, specifically within a field that combines mathematical rigor with real-world impact, such as Project B7.

What particularly draws me to Project B7 is its focus on the mathematical and computational challenges associated with cardiac dynamics. My participation in international conferences and schools on inverse problems, biophysical modeling, and numerical analysis has further solidified my interest in this field. I am excited about the prospect of contributing to developing efficient numerical methods for simulating heart function, particularly in a collaborative research environment such as CRC 1173, which aligns perfectly with my long-term aspiration to conduct impactful research at the interface of mathematics and healthcare.

With my background in numerical analysis, robust programming expertise, and deep-seated passion for applying mathematics to understand biological systems, I am confident in my ability to make significant contributions to Project B7.

Thank you sincerely for considering my application. I look forward to the opportunity to join your research group, collaborate with esteemed researchers, and further develop my expertise in computational mathematics and biomedical applications.

P.S. I am in the process of obtaining my official Master's degree certificate, which I anticipate receiving within the next 3-4 months. Unofficial transcripts and confirmation from my supervisor, Dr. Khadijeh Nedaiasl, are available immediately and I will gladly provide the official certificate as soon as it is issued.

Sincerely,

Sajed Zarinpour Nashroudkoli