Halbach Arrays in Magnetomechanics: A Promising Technology for Biomedical Applications

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This paper explores the potential of a novel device consisting of circular Halbach arrays for harnessing magneto-mechanical phenomena. Aiming to adopt the setup for biomedical applications, this work analyzes the magnetic properties and establishes its convergence with the model it was based on. Specifically, the device was modelled with the Multiphysics computational program COMSOL v. 3.5a. The first step towards this goal is to register the different operational modes of the apparatus to demonstrate its flexibility and versatility. Subsequently, fundamental quantities that are directly related to diseases, such as magnetic field strength, gradient and force are studied to determine the device's effectiveness in treating various conditions. The numerical analysis results are then validated experimentally via magnetic field measurements to evaluate potential deviations from the computational model. The results corroborate the potential of the device in a wide range of biomedical applications, especially targeted drug delivery and tissue engineering. Additionally, the demonstrated versatility of the magnet arrangements suggests possible utility in various settings and scenarios. Overall, this study offers valuable insights into the application of magneto-mechanical phenomena in biomedical engineering and provides a promising direction for further research. As the biomedical field continues to evolve, it is important to pursue innovative solutions that can potentially revolutionize the angle of approach for Theranostics. The apparatus presented in this paper paves a promising avenue leading to this aim. In conclusion, the results of this study suggest that the proposed device is a valuable tool in biomedical applications, the full potential of which remains to be identified in future research.