

UNIVERSITI TEKNOLOGI MARA

**TERAHERTZ-RAY INTERACTIONS MODELLING BASED ON X-
RAY INTERACTIONS WITH BONE**

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ABSTRACT

In this study, a model of Terahertz-ray interactions on bone tissue was developed. Due to insufficient understanding on its interactions and the lack of literatures data, the conceptual interactions model was developed based only on the physical interactions of X-ray with bone. There are two objectives in this study, namely; 1) to elucidate the physical interactions of Terahertz-ray with bone based on X-ray interactions with bone, and 2) to develop a model of Terahertz-ray interactions with bone with emphasize on scattering and absorption interaction. In developing the Terahertz-ray model, the three literature data have been extrapolated to cover the energy range from 2 to 6.2 meV. The model was analysed and simulated using Matlab software to simulate the Terahertz-ray interactions with bone and a completed application have been created named as XT-ray. The established model provides a conceptual understanding on Terahertz-ray interactions with bone which requires improvement and validation in the future especially by means of experimental data. The results pertaining to this study are the elucidation of the physical interactions of Terahertz-ray with bone. The parameters that have been compared for both rays are the production and detection as well as the scattering and absorption interactions processes. There are three different literature data that have been utilized from the infrared spectral region. As a result, it can be summarized that the rate of absorption and scattering interactions of the Terahertz-ray with bone is less than the rate of the X-ray scattering and absorption interactions with bone tissue. In brief, there are two differences between the three studies in the review namely an energy range and instrument used which are labelled as S1, S2, S3 for scattering interactions; and A1, A2, A3 for absorption interactions. The result from the S1 (scattering) and A1 (absorption) interactions are selected to develop the model of Terahertz-ray interaction with bone. The resulting Terahertz-ray Interaction Model with Bone shows the scattering interaction is directly proportional to its energy. However, the Terahertz-ray absorption interaction with bone is slightly increasing from 2 to 5 meV and beyond 5 meV to 6.2 meV, its absorption is constant.

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