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Abstract:Today the ultrasonic inspection technique is probably the most popular method for nondestructive evaluation and structural health monitoring. However, ultrasonic waves are not very effective in detecting internal defects in some materials such as ceramic foam tiles used in the thermal protection system (TPS) of the space shuttle, thick polymer composites, and polymer tiles used in various applications. Ultrasonic energy is attenuated very fast in these materials. On the other hand the electromagnetic radiation in THz (1000 GHz) frequency range can penetrate deep inside these materials. Its wavelength is small enough to detect internal defects. To understand the limits of structural damage detection capability of THz electromagnetic radiation or T-ray, mechanical damage in polymer tiles is introduced by drilling holes. Then T-ray is passed through the damaged and defect-free tiles. The received signal strength is found to be affected differently by the internal defect as the frequency changes. Experimental observations are justified from the model predictions. The model takes into account the interaction between the T-ray of finite width and the tile containing the internal defect.