THE NEED AND FEASIBILITY FOR A DYNAMIC COMPUTATIONAL HUMAN PHANTOM IN RADIATION DOSIMETRY SIMULATION USING MOTION CAPTURE DATA

By

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ABSTRACT

Most computational human phantoms are static, representing a standing individual. There are, however, cases when we are interested in simulating varying human posture, and even whole sequences of motion, for radiation dosimetry, and where a phantom is needed that can be implemented for such a simulation. This thesis describes the need and the feasibility for such a dynamic phantom by developing the Computational Human for Animated Dosimetry (CHAD) phantom, developed via modifications to the limb structure of the RPI Adult Male. This phantom was designed such that its posture could be based on anatomical information obtained using an optical motion capture system to acquire real-life human movement data. This new phantom model was tested for its preservation of dose accuracy and its ability to produce dose results that reflect the changes brought about by posture-deformation. The CHAD phantom model was then employed to perform a dose-reconstruction simulation for the 1997 Sarov criticality accident, which has been discussed extensively in the literature. Results obtained using the phantom model in a full-fledged animated dosimetry simulation were compared to dose measurements reported in the literature, and from here a correlation of the dose measurements obtained in the simulation to information on the medical outcome of the case at hand could be analyzed. Recommended next steps and future directions for this line of research are also discussed.