In this dissertation we present a study of enhanced hyperthermia for cancer treatment through the use of magnetic nanoparticles. Hyperthermia has been in use for many years, as a potential alternative method in cancer treatment. High frequency microwave (MW) radiation has been used successfully in hyperthermia to raise the tumor temperature to around 42°C in superficial tumors without causing damage to surrounding healthy tissues. Magnetic fluid hyperthermia which involves the use of magnetic nanoparticles injected into the tumor, is presented in this dissertation as a means for enhanced hyperthermia treatment. When exposed to MW radiation, the magnetic energy in the nanoparticles is converted into heat allowing for a more rapid rise of temperature in the tumor to the desired level to kill the cancerous cells. Also, the nanoparticles allow the electromagnetic absorption to be focused in the tumor and can be used to treat deep tumors in organs, such as the liver. Iron oxide magnetic nanoparticles were considered as they are non-toxic and bio-compatible. The effect of various physical attributes of the nanoparticles such as their magnetic susceptibility, size and concentration were evaluated in order to treat a cancerous tumors. Results for the specific absorption rate (SAR) and the temperatures in the tumor and surrounding tissue are presented. Simulations for the SAR and the transient temperature in the model were done using HFSS, SEMCAD and SIM4LIFE. Measurements were done on a phantom model to validate the theoretical and simulation results.

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The public is welcome to attend.