Medical Physics Seminar
Monday, October 5th, 2015
1345 HSLC ~ 4:00 P.M.

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Concurrent Monte Carlo Transport and Fluence Optimization Theory, Development and Applications

Future radiation treatment technology will require new inverse planning solutions to account for an increasing number of physical and biological parameters used for advanced delivery modes. The difficult challenge of preserving dosimetric accuracy while finding an optimal treatment plan over a vast search space would greatly benefit from Monte Carlo based dose calculation methods, which can offer improvements in dosimetric accuracy of up to 20% compared to deterministic methods. However, the dosimetric accuracy afforded by conventional Monte Carlo treatment planning methods come at the cost of being computationally time-consuming and memory-intensive to implement. This has largely relegated Monte Carlo treatment planning to research endeavors, where the computational time and memory considerations are less important than the accuracy afforded by Monte Carlo. While advancements in computer hardware and software have greatly improved the speed of Monte Carlo dose calculation methods, the computational demands of newer radiation therapy optimization problems still outpace the scalability of the current optimization paradigm. Therefore, the overarching goal of this research is to develop a novel approach to fluence optimization that directly incorporates optimization into the Monte Carlo transport process itself, in a manner that reduces both the computational time and memory penalties of performing transport and optimization separately. Additionally, the Monte Carlo methods and optimization theory developed in this work was applied to the novel MRI guided radiation therapy delivery modality, an emerging subset of image guided radiation therapy for which Monte Carlo dose calculation methods will be essential in generating safe and robust treatment plans.

1345 HEALTH SCIENCES LEARNING CENTER   4:00 to 5:00 P.M.