AbstractID: 8363 Title: 3D X-ray Angiography

X-ray angiography remains the primary means by which the vascular system is assessed for diagnosis and during treatment. The dominant use of x-ray angiography is a result of its ability to provide immediate, time-sequences of full (projection) views of the vasculature as contrast material flows through the blood vessels. Measurements of important diagnostic parameters, such as vessel diameter or percent stenosis, are then obtained from these images. However, this quantitation requires careful and accurate calibration of the magnification (and if possible orientation) of the vessel and usually assumptions about the vessel lumen shape. To obtain more accurate measurements from projection angiograms, a number of investigators have developed techniques to determine three-dimensional (3D) information using biplane systems. Using calibration objects or self-calibrating techniques, the vessel centerlines can be accurately determined such that their magnifications and orientations have accuracies of approximately 1-2% and 2 degrees, respectively. However, reconstruction of the vessel lumen using only two views often requires use of assumptions about the lumen shape (e.g., elliptic) and/or about the distortions from this assumed shape (say due to plaque intruding into the lumen). With the advent of rotational angiographic systems and multi-detector computed tomography (CT) scanners, the vessel lumen can be reconstructed using filtered backprojection or Feldkamp techniques, albeit usually with reduced resolution as compared with standard angiograms and without the real-time, interactive capability needed during interventions. From single plane to tomographic techniques, accurate 3D vascular information can be obtained, however choice of the technique or techniques to be employed requires understanding of the advantages and disadvantages of the various techniques. The objectives of this course are (1) to provide an understanding of the basic theory associated with each of the techniques (single plane through tomographic) and (2) to explain the requirements, assumptions, accuracies, and limitations of each of the techniques, and (3) to render the current state of the art in 3D x-ray angiography. Research supported by USPHS grant number NIH RO1-HL52567 and The Toshiba Corporation.