In the past decade, the fluoroscopic systems equipped with image intensifiers had benefited from various technical advances in x-ray tubes, x-ray generator design, and application of spectral shaping filter. While the photoconductor (or, phosphor plate) x-ray detectors and signal capture thin-film-transistor (TFT) arrays and charged couple detector (CCD) devices are analog in nature, not until the advent of flat panel image receptor (FPIR), the fluoroscopy procedures would become a totally digital process through out the entire imaging chain.

However, irrespective of the fluoroscopic image receptor; i.e., whether it is the image intensifier (I.I.) or a flat panel image receptor (FPIR), and whether the image signals are “analog” or “digital” in nature, the entire imaging system is under the command of the automatic dose rate control (ADRC) system. In fact, the ADRC is the command center of the fluoroscopic operation (Fluoroscopy Mode), and the image acquisition operation (Acquisition Mode). For the present day ADRC to function properly, there were three relatively important technical innovations that needed to be “in place”. They are (1) high heat capacity x-ray tube, (2) the medium frequency inverter type generator with high performance switching capability, and (3) the patient dose reduction spectral shaping filter. These three underlying technologies were tied together through the ADRC logic, installed first on cardiovascular angiography systems, so that the patients receiving cardiovascular angiography procedures can benefit from “lower patient dose” with “high image quality” with optimal contrast.

In the center of the ADRC logic is the “fluoroscopy curves” which determine the exact behavior of the fluoroscopy imaging chain. Examples of how the “fluoroscopy curves” can be reconstructed from the experimental arrangement and the data sets obtained from the same will be demonstrated. It will be shown that a given cardiovascular imaging system functions and responds as a totally different imaging system depending on the fluoroscopy curve that is loaded as the default system curve.

In this presentation, the focus is on the “fluoroscopic mode” of the ADRC, and the advances in the ADRC design is reviewed starting with the early models of automatic brightness control (ABC) and automatic gain control (AGC) equipped fluoroscopy, and leading to the present day ADRC design. Thus, the main thrust of this presentation is to reveal and evaluate the details of the ADRC logic as seen from equipment operation and fluoroscopists’ point of views, and to show how the ADRC can be evaluated to understand the challenges of various clinical applications are met with different “fluoroscopy curves”.

Educational Objectives:

(1) To understand the basic ABC and ADRC system design.
(2) To understand why the present day ADRC is able to reduce patient air kerma and yet still provide “high” contrast images.
(3) To understand the importance of “fluoroscopy curves” in the application of clinical procedures.