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Digital radiography system

In 1895, German physicist Roentgen discovered x-rays. Over a hundred years, X-rays have been used in different spheres of science. Today, X-rays are widely used in medicine, industry, science, etc. X-ray is a short wavelength, high frequency electromagnetic radiation, and the principle of X-ray detection is to use strong penetrating power of X-rays. The X-ray band penetrates through the inspected object, and thus we gain the information on this object. We can detect and evaluate the nature, size and distribution of defects inside the material or the final product by the variation of the X-ray intensity. Digital radiography technology is widely used in X-ray non-destructive testing [1].

The term «digital radiography» refers to a set of methods of nondestructive testing and diagnostics, in which the radiation image of the inspected object is converted at a certain stage in a digital signal. Next, this digital signal is stored in the computer's memory and there it is redistributed in the two-dimensional array of measured data that can be subjected to various types of digital processing (contrast calibration, preparation, smoothing, etc.) and finally, it is displayed on a graphic display screen or a TV-monitor as a grayscale image perceived directly by the operator [2].

Digital radiography can be divided into CR and DR [3].

CR systems use storage-phosphor image plates, and they provide a separate image readout process; DR is a way of converting x-rays into electrical charges through a direct readout process. DR systems can be further divided into direct and indirect conversion groups depending on the type of x-ray conversion used (fig. 1) [3].

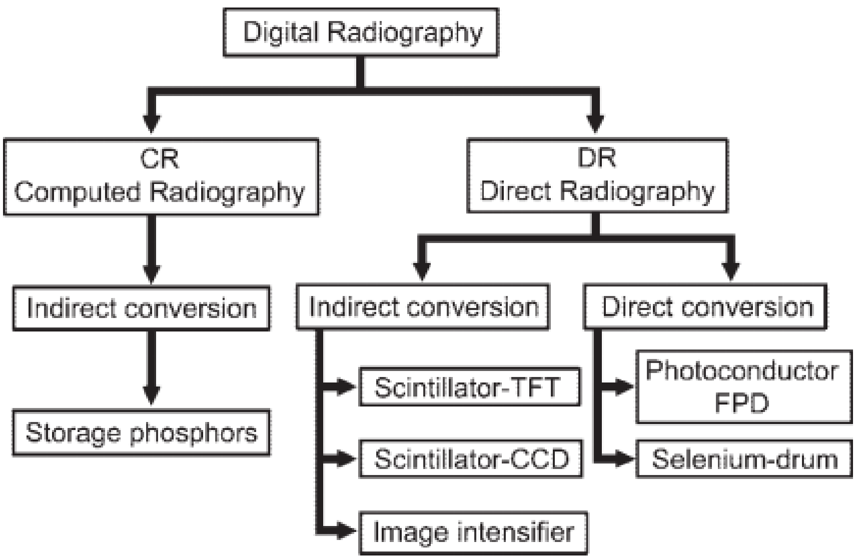

Fig. 1. Chart for various types of digital detectors [3]

Fig. 1 shows a chart for various types of digital detectors. In the chart, CCD = charge-coupled device, FPD = flat-panel detector and TFT = thin-film transistor [3].

Radiation sources in these systems are usually X-ray machines, and sometimes (in the control of large objects in particular) betatron and linear accelerators are applied [2].

In order to increase the informative value of the control (diagnostics), some digital radiography systems operate in a dual-energy mode (implementing the method of dual energy), when the object under control is X-rayed twice, at two different voltages of the X-ray tube (which corresponds to two different efficient radiation energies). Sometimes we need to obtain high-quality images of an extended object, based on application of one or another digital radiography system. In this case, the radiography of the object is performed in parts. The received image slices are "linked" to obtain a full image by using special algorithm of digital information processing [2].

Currently, the digital radiography system is widely used in industrial inspection, medical diagnostics and to inspect baggage, handbags, sealed containers, etc. in order to ensure the safety of passenger and freight traffic [2].

In Nondestructive Testing Institute of Tomsk Polytechnic University was created Laboratory of Technical Tomography and Introscopy in 2010 year by merging departments № 10, № 84 and laboratory № 82 of Scientific Research Institute of Introscopy, whose existed from day of Institute foundation in 1968 year. Its priority directions of research are Develoment and production of hardware and software for systems of betatron and digital radiography. The base activity directions of laboratory are: radiational introscopy, radiational albedo control, automation of radiational inspection results [4].

References

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