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IMITATION MODEL OF SOURCE INFORMATION FORMATION IN HIGH ENERGY DIGITAL RADIOGRAPHY AND COMPUTER TOMOGRAPHY SYSTEMS

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Nowadays, high-energy radiation sources are increasingly used in nondestructive X-ray inspection. The main reason for the growing popularity of gamma radiation sources with electron energies of more than 1 MeV is the possibility of their application in high-energy radiographic control with innovative digital systems. Such systems have the advantages of high penetration, high sensitivity of defect detection and can meet the needs for inspection of large complex structures.
The subject of our study is high-energy digital radiography and computed tomography systems. We have studied simulation models and programs that are used to create initial information in digital radiography and computed tomography systems. Our goal is to develop mathematical models, based on known physical laws of X-ray-matter interaction, for creating digital radiographic images and projections using a betatron radiation source with different parameters. We investigated the influence of betatron parameters, detector, collimator and object velocity on the obtained images. In the course of our study, we analyzed the existing scientific, technical and methodological literature related to mathematical and numerical modeling of high-energy digital radiography and computed tomography systems. We have developed mathematical models of these systems that take into account the features of scanning geometry and detector characteristics based on the American standard N42.46. Our models allow us to estimate the penetrating power, the limit of detection by wire diameter, horizontal and vertical spatial resolution, and contrast sensitivity.

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