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Sound and Vibration Nonauditory Effects: Intriguing Topics in Medical Physics

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Abstract

The existence of nonauditory effects produced by music, noise and infrasound, which partly recall whole-body vibration effects, suggests that acoustic waves can affect humans not only through the auditory apparatus (cochlea, cranial nerves, brain centers), but also through other than hearing tissues. From this hypothesis, which stems from literature data as well as from biophysical knowledge, new possible areas of research in Medical Physics arise.

Indeed, the physics of sound and vibration, together with the acoustic properties of tissues, are the necessary starting points from which to examine the spatial distribution of mechanical energy throughout the body. Consequently, the possible medical applications, as well as damage and claims in occupational medicine, might become areas of interest for medical physicists.

KEYWORDS: Mechanical energy effects, Nonauditory effects, Hand-arm vibration, Whole-body vibration.

Technical Note

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Enhanced dynamic wedge: dosimetry and clinical implementation

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Abstract

The Varian Enhanced Dynamic Wedge is a dynamic modality implemented on Clinac 2100 C/D and 600 C linear accelerators in order to obtain wedge angles just by the sweeping of one of the secondary collimators (y1 or y2) across the field. The Segmented Treatment Tables of instruction define dose rate modification according to jaw position and the same tables are implemented on Cadplan treatment planning system.

The EDW implementation supports standard wedge angles of 10°, 15°, 20°, 25°, 30°, 45° and 60°, and field dimensions up to 30 cm in the wedge direction. Before routine clinical use, dosimetric verifications are required to verify proper working of the modality and Cadplan calculation.

KEYWORDS: Enhanced Dynamic Wedge, Film, Dosimetry, Treatment Planning.

Steady flow visualization in a rigid model of the aortic-renal junction: application to atherosclerosis

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Abstract

The steady flow conditions in a rigid model of the aortic-renal junction were studied in the relation to atherogenesis in humans. The streamline flow patterns were visualized by a slow injection of dye at different locations over the cross section of the tube entrance and through small holes machined along the tube walls. The particle residence time was estimated by measuring the washout time of a bolus of dye injected at the separation point. Streamlines deviate, in general, towards the branch orifice. Streamlines located near the outer (dorsal) wall of the trunk drifted towards the inner wall after passing the branching region, but they sometimes change direction and entered the branch. Streamlines near the ventral wall of the trunk entered the side branch directly. In the side branch the streamlines moved towards the inner wall of the branch and this results in a secondary flow with helical motion. Two boundary layer separation zones were observed to occur in the model, one was found at the outer wall of the trunk and the other at the outer corner of the branch. Fluid within separation zones exhibited helical (disturbed motion) with prolonged residence time. The residence time was found to decrease as the Reynolds number increase. The size of the separation zone in the trunk increases as the outflow into the side branch increased, while the size of the separation zone in the branch increased as the outflow into it increased for the range of flow ratio of 0.0 to 0.5. This size however was found to be smaller at a flow ratio of 0.65. A long residence time would mean that atherogenic particles trapped within the separation zones will have a greater probability of being deposited there.

KEYWORDS: Streamline, Separation zone, Flow ratio, Residence time, Ssecondary flow.

The DICOM file format: postprocessing features in MRI

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Abstract

This paper describes the DICOM (Digital Imaging and Communications in Medicine) file format and reviews our experience in using DICOM formatted image file to perform quantitative analysis of magnetic resonance (MR) images.

KEYWORDS: DICOM, Magnetic resonance, Postprocessing, Image format.