



Theory of Quantitative Magnetic Resonance Imaging

Hernán Jara

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qMRI is a rapidly evolving scientific field of high current interest because it has the potential of radically changing the clinical and research practices of magnetic resonance imaging (MRI). This focuses solely on the theoretical aspects of qMRI, which are treated and analyzed at three different spatial scales, specifically: i) the quantum physics scale of individual spins; ii) the semi-classical physics scale of spin packets; and iii) the imaging scale of voxels. Topics are presented paying particular attention to theoretical unification and mathematical uniformity.

Contents:

- Introduction
- Elements of Imaging Theory
- Physics of Quantitative MRI
- Elements of Relaxation Theory
- QMRI Theory
- QMRI Processing
- Introduction to Applications of QMRI

Readership: Graduate students in physics and biomedical engineering disciplines, engineers and practitioners in biomedical engineering, MRI equipments and image processing industry.

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Magnetic resonance, absorption or emission of electromagnetic radiation by electrons or atomic nuclei in response to the application of certain magnetic fields. The principles of magnetic resonance are applied in the laboratory to analyze the atomic and nuclear properties of matter. Electron-spin. Figure 1: Precession of a magnetic dipole moment $\hat{\mu}$ in the presence of a constant field H and a rotating field $H \hat{\epsilon}^2$ (see text) Encyclopædia Britannica, Inc. In magnetic-resonance devices, a weak oscillating field ($H \hat{\epsilon}^2$) is superimposed on a strong constant field (H), as shown in Figure 1, and its vector rotates with an angular velocity ($\hat{\epsilon}^{\circ}$) in a plane perpendicular to the direction of the strong field. Elements of imaging theory. Hernán Jara. Published: 16 April 2013. by World Scientific Pub Co Pte Lt. in Theory of Quantitative Magnetic Resonance Imaging. Theory of Quantitative Magnetic Resonance Imaging pp 7-19; doi:10.1142/9789814295246_0002. Show/hide abstract. The publisher has not yet granted permission to display this abstract. by World Scientific Pub Co Pte Lt. in Theory of Quantitative Magnetic Resonance Imaging. Theory of Quantitative Magnetic Resonance Imaging; doi:10.1142/9789814295246_fmatter. Show/hide abstract. The publisher has not yet granted permission to display this abstract. Publisher Website. Google Scholar. Theory of Quantitative Magnetic Resonance Imaging. Hernán Jara. Magnetic resonance imaging (MRI) is a medical imaging technique used in radiology to form pictures of the anatomy and the physiological processes of the body. MRI scanners use strong magnetic fields, magnetic field gradients, and radio waves to generate images of the organs in the body. MRI does not involve X-rays or the use of ionizing radiation, which distinguishes it from CT and PET scans. MRI is a medical application of nuclear magnetic resonance (NMR). NMR can also be used for imaging in other