Calculating Strains from Tagged MRI

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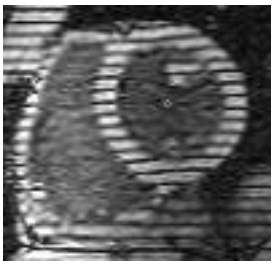
The physics behind the tagged MRI follows the same principles as a regular MRI. The patient is loaded in the bore of the MRI which is surrounded by a superconducting magnet and three gradient magnets. The superconducting magnet is nothing more then wire or coil wrappings to pass current. The wire wrappings are saturated in liquid helium at 452.4 degrees below zero, which will lower the resistance in the wire to basically zero. This makes it very easy to create a magnetic field, which is very intense and stable. The gradient magnet will create a variable magnetic field. The part of the patient's body that is being scanned has to be in the isocenter of the bore.

The hydrogen atoms in the body once excited by the radio waves align with the magnetic field. The use of hydrogen atoms is used because there is an exuberant amount of them in the body and they have a large magnetic moment.

The signals that are released by these atoms will be processes through a Fourier Transform and the image will be created.

A tag is a region of the sample where the magnetic moments of the hydrogen nuclei have been perturbed, producing an area of signal contrasts. Since the tags result from an alteration of the tissue itself, the deformation of each tag line faithfully reflects the motion of the underlying tissue. Typically, tags are created at end diastole where the cavity volumes are the largest.



The strains are then computed from a series of tagged images. A material point is a physical piece of myocardial tissue. The description of the deformation in the neighborhood of a material point begins with the task of tracking these tags in time and space. The motion of the tags are described by the 1-D displacement gradient and the strains are found from the Lagrangian Strain Tensor

References:

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