Improved Mode Number Identification of Low-frequency MHD Activity in NSTX

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Magnetohydrodynamic (MHD) oscillations have been measured with Mirnov coils in the National Spherical Torus Experiment (NSTX). An improved analysis algorithm has been developed to determine the poloidal and toroidal mode numbers (m and n) of these oscillations. First, the algorithm allows for a time-changing oscillation frequency of a given mode in order to accurately track the mode phase evolution. This allows the toroidal and poloidal mode numbers to be accurately tracked over much shorter time periods than can be achieved using simple windowed FFT techniques. Second, the low aspect ratio of NSTX causes the poloidal measurements to be highly asymmetric between inboard and outboard sensors. This toroidal effect is usually accounted for in high aspect ratio devices by a transformation of the poloidal angle (θ), which includes a $\sin(\theta)$ term. Improved poloidal mode number identification is achieved here by including higher harmonics of $\sin(\theta)$ in the transformation. The weights of the harmonics and the dominant poloidal mode number are determined by performing an iterative search for the minimum error of the mode number fits. Together, m and n determine the dominant helicity of the modes. The oscillation frequency is then compared to the plasma rotation frequency (determined by charge exchange recombination) at the q surface corresponding to the measured helicity.