

A DFT-based Phase Locked Loop for Phase and Amplitude Tracking in Aircraft Electrical Systems

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Abstract- Phase locked loop (PLL) algorithms are commonly used to track sinusoidal components in currents and voltage signals in three phase power systems. Despite the simplicity of those algorithms some drawbacks arise when signals have variable amplitude or are polluted with relevant harmonic content and measurement noise. These are typical conditions in aircraft ac power systems, where the fundamental frequency can be variable in the range 360-900Hz. To improve the quality of phase and frequency estimates in such power systems a novel PLL scheme based on a real-time implementation of Discrete Fourier Transform (DFT) is presented in this paper. The DFT algorithm calculates the amplitudes of three consecutive components in the frequency domain that are used to determine an error signal to be minimized by a PI controller that estimates the fundamental frequency. The integral of the estimated frequency is the estimated phase of the fundamental component that is fed back to the DFT algorithm. The proposed algorithm can be then reviewed as a PLL in which the phase detector is performed via a DFT-based algorithm. A comparison between the performances of standard PLL and the proposed DFT-PLL has been realized using computer simulations and experiments.