Design of the Digital RF Control System for the TESLA Test Facility, I. ALTMANN, K. REHLICH, T. SCHILCHER, S.N. SIMROCK*, DESY - The cavities in the TESLA Test Facility are operated in pulsed mode at gradients of up to 25 MV/m with each klystron driving multiple cavities. Significant Lorentz force detuning and control of the vector sum are the main issues for the low level rf controls. A digital feedback system has been developed to provide flexibility in the control algorithms, precise calibration of the vector sum, and extensive diagnostics and exception handling. The main features are a sampling rate of 1 MHz for the individual cavity signals, digital in-phase and quadrature detection, calculation of the vector sum which includes gradient calibration and the correction of phase offsets, and feedback algorithm. The algorithm includes time-optimal control and a Kalman filter to correct for loop delays of the order of several μs and provide an optimal state estimate in presence of detector noise. An attempt is made to optimize the complexity of the feedback algorithm versus the computational delay.

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