Energy Stability in Recirculating, Energy Recovering Linacs in the Presence of an FEL*, L. MERMINGA, J. BISOGNANO, CEBAF - Recirculating, energy-recovering linacs can be used as driver accelerators for high power FELs. Instabilities which arise from fluctuations of the cavity fields are investigated. Energy changes can cause beam loss on apertures, or, when coupled to M_{56}, phase oscillations. Both effects change the beam induced voltage in the cavities and can lead to unstable variations of the accelerating field. An analytical model which includes amplitude and phase feedback, has been developed to study the stability of the system for small perturbations from equilibrium. The interaction of the electron beam with the FEL is a major perturbation which affects both the stability of the system and the development of start-up and recovery scenarios. To simulate the system's response to such large parameter variations, a numerical model of the beam-cavity interaction has been developed which includes low level rf feedback, phase oscillations and beam loss instabilities and the FEL interaction. The model has been benchmarked against experimental data obtained during CEBAF's high current operation. Extensive simulations have been performed and a start-up scenario has been developed for the high power IR FEL proposed for construction at CEBAF.

* Work supported by the Department of Energy contract #DE-AC05-84ER40150.