FEL and Longitudinal Instabilities in Storage Rings, G. DATTOLI, L. MEZI, <u>A. RENIERI</u> - ENEA; M. MIGLIORATI - UNIVERSITA DEGLI STUDI DI ROMA "LA SAPIENZA", INFN LNF - FEL operating with Storage Rings (SR), may inhibit the growth of instabilities. The explanation of these effects are related to the interplay between the modifications induced in the e-beam longitudinal dynamics by the FEL and those supporting the growth of the instability. The microwave instability (MI) is counteracted by the FEL, because: a) induced energy spread; b) energy dependent corrections of the damping time. The first mechanism causes a shift of the MI threshold. The FEL induced variations of the longitudinal damping time provide a fast damping of the higher order modes. In the head tail (HT) case, the feedback loop is provided by the gain variation induced by the growth of the e-beam transverse dimensions and by the variation of the instability growth rate associated to the FEL induced energy spread. We combine the rate-equation-SR-FEL model and modified Haissinsky equation to analyze the MI. The analysis of the HT-FEL interplay, is based on the same FEL model, and that of the instability is accomplished by using the broad-band-impedence and water-bag approximation. In both cases a satisfactory description of the FEL instability mutual feedback is obtained.