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DESIGN OF A FEEDBACK SYSTEM TO STABILISE INSTABILITIES BY ECRH USING A COMBINED ECW LAUNCHER AND ECE RECEIVER

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At the TEXTOR tokamak a 140 GHz, 800 kW, 10 second gyrotron is employed for studies on ECW heating and ECCD current drive. One of the applications is the suppression of tearing modes, and at present a method is under development which aims to detect the ECE perturbations caused by these modes via the same line of sight as is being used to launch the gyrotron power and to use this information for feedback control of the instability. A considerable advantage of this scheme is that by moving the in-vessel launcher of the ECW installation, the gyrotron line of sight can be swept poloidally through the plasma. Each time a mode is encountered there will be exact spatial overlap with the gyrotron deposition profile when the mode is centred around the gyrotron frequency in the observed ECE spectrum. By applying gyrotron power at the correct time, fast and efficient suppression of the mode should be guaranteed.

We report on the overall design of the system that aims to detect the perturbations on the ECE temperature profile, locks the steerable ECRH launcher onto the position of this disturbance and applies the gyrotron power at the correct phase with respect to the period time of the disturbance.
A brief overview of the steerable launcher and of the ECE receiver in the ECRH transmission line is given. The proposed circuit to positively identify the island and it's O-point, derived from the phase relation between the ECE signals, is discussed.
In the most basic, but elegant mode of operation, the ECE signals are the only input signals the control system needs in order to find and suppress the instabilities. To optimise the process, advanced knowledge of the possible location of the islands can be derived from the q profile of the plasma, and feed forward can be applied in the controller by making use of the frequency at which the islands rotate.