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10.49 A Non-Invasive Method of Measuring the Height of Liquid-Metal Surface Waves

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Liquid-metal plasma facing components (LM-PFC's) could provide fusion reactors with improved tritium breeding capabilities, enhanced power removal, and 'self-healing' interior surfaces that are immune to both radiation damage and thermal stress. During reactor operation, fast-moving, smooth-flowing LM-PFC surfaces are preferred since surface waves may cause non-uniform heating of the LM-PFC and splashing of liquid metal could upset or extinguish the plasma. However, surface waves and instabilities on LM-PFC's can be caused by a number of different factors including interactions with tokamak surfaces (e.g. diagnostic ports), magnetic transients, and interactions with the 'plasma wind'. Identifying the location and measuring the amplitude of liquid-metal waves during reactor operation is an important step towards minimizing and controlling them. Therefore, a non-invasive electromagnetic diagnostic has been developed to quantify localized surface waves in LM-PFC's. This low-cost diagnostic is installed beneath the substrate that the liquid-metal flows so it is insulated from thermal transients. This paper provides details on the design, construction, and operation of the new diagnostic. Experimental data is compared to numerical results.

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