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## 8.37 Measuring non-axisymmetric fields from internal and external sources in the DIII-D tokamak\*

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The magnetic field on a closed surface can be uniquely decomposed into contributions from currents internal and external to the surface [A.H. Boozer, Nucl. Fusion 55, 025001 (2015)]. In the context of a magnetic fusion device, this general principle implies that given a sufficient set of magnetic diagnostics just outside the plasma surface, the plasma's contribution to the magnetic field can be distinguished from that of external currents – without the need for a specific model of either the plasma or the external currents. For example, this principle enables a direct measurement of the field of a growing plasma instability, without the need for a model of the currents that it induces in the resistive vessel wall. Similarly, it allows a direct measurement of the stable plasma response to an external magnetic perturbation, separate from the field of the external coils that impose the perturbation. We will discuss the requirements on magnetic diagnostics for such measurements. Applications of the technique to measurements in the DIII-D tokamak will be shown, including the case of a rotating tearing mode as it becomes locked to the wall.

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